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Briefly Noted

Lady Angler. By Harriet Wheatley. San Antonio, Texas. 1952. The Naylor Co. 192 pages. Illustrated. $5.00.

This is an account of fishing, hunting and camping in wilderness areas of North America by a woman who likes to fish and, occasionally, to hunt.

Calling All Varmints. By Bert Popowski. Harrisburg, Pa. 1952. The Stackpole Company. 308 pages. Illustrated. $4.00.

The author of this book is an ardent anti-predator and he uses this volume to show gunners how they can have wild targets when seasons on legitimate or legal game are closed.

Grand Tour and Other Poems. By Mary F. Lindsley. New York. 1952. Philosophical Library. 128 pages. $4.75.

A varied collection of long and short poems against different geographical backgrounds and with a lot of history.

Opticks. By Sir Isaac Newton. New York. 1952. Dover Publications. 406 pages. $1.90, paper; $3.95, cloth.

This is based on the fourth edition of this famous work, which was "A Treatise of the Reflections, Refractions, Inflections, and Colours of Light."

The Generic Names of the Beetle Family Staphylinidae. By Richard E. Blackwelder. Washington, D.C. 1952. Smithsonian Institution. 481 pages. Available from Superintendent of Documents, U.S. Government Printing Office, Washington 25, D.C. $1.50.

This listing of generic names is preceded by an essay on genotypy.

Fishing behind the Eight Ball. By Harlan Major. Harrisburg, Pa. 1952. The Stackpole Company. 254 pages. Illustrated. $3.00.

A discussion of anglers' problems in many parts of the world by one who has fished far and wide.

Fleas, Flukes and Cuckoos. By Miriam Rothschild and Theresa Clay. New York. 1952. Philosophical Library. 304 pages. Illustrated. $3.75.

A collaboration by two zoologists who have for many years specialized in the study and collection of bird parasites.

The Tree of Human History. By Alan Houghton Brodrick. New York. 1952. Philosophical Library. 253 pages. $4.75.

A lively and connected account of the events that led up to the appearance of civilizations and their arts.

Folk Tales

The Hen that Saved the World, and Other Norwegian Folk Tales. Retold by Margaret Sperry. New York. 1952. The John Day Company. 64 pages. Illustrated by Per Beckman. $2.25.

The author of this attractive little book spent her early childhood in Scandinavia and now lives in Sweden. She has not only translated favorite folk tales of Norwegian children but has retold them in a way to enhance their appeal to English-speaking boys and girls.

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Nature in Print

By HOWARD ZAHNISER

WHEN my friend Paul H. Oehser recently used the introduction of a Nature in Print essay written in my absence to comment on the policies that have governed these pages, it recalled to my mind a discussion that Edwin Way Teale once intrigued me into before the American Nature Study Society. Since then it has occurred to me that perhaps such a discussion — an *apologia pro scripta sua*, as it were — might well be presented here, and my good editor has concurred. What our readers think of these policies would, indeed, be of interest to us both, as especially would be any improvements that might be achieved as a result of these professions and the comments they might occasion.

When Edwin Way Teale extended his invitation he asked for a discussion "On Book Reviewing." I had to, then, and I must now, preface any other remarks with a demurrer and confess that my experience has not at all been that of an objective critic. What I have written have been appreciations. My good editor has not imposed on me the duty of writing appraisals of all the Nature books that are published. In the course of the years I have, indeed, read or examined a number of books that seemed to me faulty or unworthy, but it has been my privilege to keep still about them. I do not disparage the function of the critic who undertakes to appraise objectively the books in his field and to give spankings where they seem needed. There is a public need for critics who discourage the unworthy and expose the faulty. I recognize this. It simply has been my preference — and what I have judged to be the preference of whatever readers I have had — to devote my attention to the books that seem worthwhile. My experience with books is a very personal one, as you will see, and I do not care to go too far with one that is unworthy.

In writing for those who are devoted to the study of Nature I do not know why I should not face the facts of life frankly and speak in all candor. Producing a book review that is alive and real, I must say, is like having a baby, and I can best explain it by recognizing this simple fact. Of course, once again, the experience on which I must rely for this explanation is limited. For my production of book reviews has been entirely a maternal experience, and this maternal experience, so far as babies are concerned, is one that I have only observed. At any rate, I must do my best to explain these matters to you — an always difficult thing to undertake. And do not ask questions!

In brief, I can tell you at once, out of my many maternal experiences in writing book reviews, it is an exciting and satisfying experience to read the book and observe its illustrations, a long and toward its end a burdensome thing to develop the review, ever present in mind, and finally a labor — although of love — to *write* the review. Many times in my experience the actual writing has, in fact, been so long delayed as to have to be induced by my obstetrical editor. And, incidentally, I may add, it has been a matter of deep gratitude to me to have an editor who will take a new-born manuscript and polish it as needed, clothing it in good style, and yet not try to switch babies on me.

Thus you can see that, in my opinion, a vital book review has a character or personality of its own. It is a new creation, an entity in itself. To those who are concerned with its subject matter, or to those who may become so concerned, it should, in other words, have an intrinsic interest. The shaping of this personality of the review, its endowment with a reader interest that is peculiarly its own, is the privilege of the reviewer. If the review lacks interest of its own, if it is merely descriptive of a book, the fault is surely the reviewer's and, I sometimes surmise, the result of insufficient thought or meditation. I might say gestation. Reviews should be fully matured, and they should surely be endowed with some of the good graces of the reviewer, which led someone to propose that he, or she, become the reviewer.

At the same time it is a wise book review that shows its own father. When you read the title-page summaries before some reviews and then go on past the by-line of the reviewer to the review itself you get suspicious. Some seem so much unlike the book that you wonder, in fact, if perhaps the reviewer has been playing around too much with other books.

That is bad. The faithful reviewer will delight in seeing in the review the earmarks of the book, and not only quotation marks either. A book review is a public event, and it should be deemed an immoral act for a reviewer, in public, to ascribe a review to a book to which it is not properly related.

The review that I am discussing as to my Eking will show throughout its dual ancestry. It may find faults. That certainly is a privilege of the relationship, but the reviewer surely should not disown the book. It would be better, it seems to me, to get quietly another book. I trust that in my own reviewing I have been faithful to my books. It is a virtue I covet.

Although I must confess that I have been a rather promiscuous reader, and reviewer, within my range, I have tried to see that the various books I have espoused for review are in a respectable series. At any given moment I am a monogomist, although a rather strange one, I must admit, for I have never yet been jealous because my book of the moment had so many other reviewers.

It has been one of my own poignant pleasures as a reviewer to have an author of a book that has begotten one of my reviews write me with appreciation for having understood what the book was getting at — as though this were an unusual virtue. It has so frequently been the basis of such author responses as we have had here at *Nature Magazine* that Mr. Westwood and I have several times discussed how pitiful in a way it is that so many authors especially appreciate a reviewer that simply understands the book and its purpose.

I feel like emphasizing, to myself and to any other reviewers, this obligation to the books that we undertake to introduce to our readers. (Authors, in this analogy, I suppose are mothers-in-law and do have some rights of protest with regard to how their books are handled.)

In this respect, with reference again to the review as an entity of its own, I feel that its readers should know something of the parentage. I like those reviews that let the reader know what, as well as who, the reviewer is, and I think it essential that the physical facts of the book should be known also, in detail. Yet I do not consider this as an integral part of the sort of review I am discussing. It rather is an essential appended or prefaced note as to the paternal parent of the review, if I may thus conclude my analogy — an analogy which I invite you to contemplate further at your leisure.

It seems to me that book reviews are a peculiarly advantageous means for our educational work in advancing Nature understanding and appreciation. We should devote more attention to them. A book is a surpassingly great achievement of a thinker — explorer—writer. In books are the great ideas, and the enduring records. Yet there are so few readers of books, and fewer still of the good books. Through the sort of review we have here been discussing I believe we should endeavor to do much more than we ever have before to disseminate more widely the ideas and influences of our books, and to increase the number of those who read the books themselves.

November

By GILEAN DOUGLAS

No polonaise of fire from beech and oak,
No fluted winging;
Earth is a diluendo note —
But rain is singing.

Channel Island Birds

The Birds of the Channel Islands. By Roderick Dobson. New York. 1952. Staples Press. 263 pages. Illustrated. $6.00.

The Channel Islands, lying between England and the mainland of Europe, have been the subject of many articles and books and have provided the setting of many stories. One of the interesting aspects of these islands is its bird life, and this is a book about that bird life. The author has been for many years a farmer on the Island of Jersey, and has widely visited and studied the varied bird life on the other islands, islets and reefs. Some 250 different species have been recorded from these channel-girt dots on the map, and the author has written his book to bring together the scattered records of a century.

Climbing Yerupaja

The Butcher. The Ascent of Yerupaja. By John Sack. New York. 1952. Rinehart and Company. 213 pages. Illustrated. $3.00.

This is the story of a mountain climbing adventure and the conquest of Mount Yerupaja in Peru, reputedly the highest unclimbed peak in the New World. It is an account of this climb by five boys from Harvard University and two from Stanford. They set out in 1950 for an ascent that was said to offer a chance of one in four that they would give their lives in the attempt. The climb nearly did end fatally for two of the party, but they made it, and this account is a fascinating report of the adventure.

Poems by Douglas

Now the Green World. By Gilean Douglas. The Wings Press. 1952. Box 332, Mill Valley, California. 56 pages. $2.00.

This poet has gradually been building up a loyal following among lovers of poetry. It is time, therefore, that a collection of his poems should appear between covers, and in this book they do so under attractive auspices. It is a careful selection of fine poetry, to which The Wings Press has given a lovely piece of bookmaking for a setting.

Follow the Sunset

Follow the Sunset. By Herman and Nina Schneider. New York. 1952. Doubleday and Company. 43 pages. Illustrated in color by Lucille Corcos. $2.75.

This is a "Junior Book" for "our children on whom the sun rises and sets." This will answer many questions in a delightful way. The youngster who wants to know where the sun goes; what makes the new day come; what happens in other lands can find the answers here. This is charming astronomy — or a bit of it — combined with geography. No few parents will learn something from it, too.

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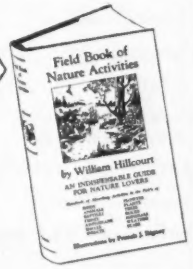

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The American Nature Association

1214 SIXTEENTH STREET, N. W., WASHINGTON, D. C.

By Way of Report

REPRESENTING the American Nature Association, one of the founding members of the International Union for the Protection of Nature, President Richard W. Westwood attended the sessions of the Third General Assembly of I.U.P.N. in Caracas, Venezuela, in early September. Fuller report on that meeting is to be found elsewhere in this issue of the magazine. Mr. Westwood is also president of the Commission on Public Information of the Union and a member of the Executive Council. The work of the Commission has been made possible through a grant from the American Nature Association, with the cooperation of the Charles Lathrop Pack Trust. Dr. Charles J. Bernard of Switzerland was reelected president of I.U.P.N., and William H. Phelps, Jr., of Venezuela was elected one of the three vice-presidents, replacing Dr. Roger Heim of France, whose term had expired. The Union voted to hold the Fourth General Assembly in Copenhagen, Denmark, in 1954. Denmark is one of the countries subscribing to the Union. Technical sessions will be held in Salzburg, Austria, in 1953.

ON JULY 24, Dr. E. Laurence Palmer, our Director of Nature Education, ended 33 years of service at Cornell University. President Deane W. Malotte, friends on the faculty, and many former students honored him at a testimonial dinner on September 3. The American Nature Association was represented by Harry E. Radcliffe, Vice-President.

Dr. Palmer, a dynamic character with a great capacity for work, is not retiring from work — just dropping his academic duties in order to carry on his work of Director of Nature Education for the Association, as a member of the Committee on Conservation of the National Wildlife Federation, and to write two or three books he has had in mind for some time. His work for *Nature Magazine* is widely known. For 27 years he has been writing a monthly department in *Nature Magazine*, designed to be helpful to teachers of Nature study and elementary science.

In 1928, Cornell University announced the American Nature Association-Pack Fellowships in Nature Education and Forestry under Dr. Palmer. Today more than fifty Doctors of Philosophy are holding important positions in colleges, universities, federal and state governments as a result of these fellowships. All are doing splendid work in the interest of resource-use education.

A PROGRAM on Conservation Education, or Resource-Use Education, was held at Purdue University, Lafayette, Indiana, September 15-19. The American Nature Association was represented by our Vice-President, Harry E. Radcliffe, and Dr. E. Laurence Palmer, our Director of Nature Education. The meeting was under the joint auspices of the Conservation Foundation and National Committee on Policies in Conservation Education. Leading educators and conservationists from throughout the United States were in attendance. It was significant and inspiring to see seven educators who had done their graduate work under American Nature Association-Pack Scholarships at Cornell University taking an active and vital part in the discussions.

It is as difficult to get unanimous agreement on the details of a program from a group of educators as it is from a group of conservationists, but there seemed to be agreement that resource-use education must consider the entire natural resource base — including human beings — and not only renewable natural resources; that conservation, or resource-use, education should be in school curricula at all levels — elementary, junior high, high schools, both urban and rural, and teachers' colleges, colleges and universities; that in elementary and high schools the subject should be integrated into the existing courses, and teaching should be on a "problem-centered" basis — using local, state and regional problems to arouse and maintain interest.

There seemed agreement that at college levels a special course on resource-use education might be advisable, as an elective or a major course, together with certain other subjects; at graduate school level there should be a course on conservation education taking into consideration the natural resource problem on a world-wide basis; both pre-service training and in-service training should be given to teachers. It was also felt that resource-use workshops are the best method for in-service training and speeding up the whole program.

TWO recommendations of the Commission on Public Information, I.U.P.N., were approved by the Third General Assembly. One proposed the creation of an organization to be known as Friends of I.U.P.N. Membership in the Union is confined to governments and organizations. However, there are many individuals interested in the international conservation picture. Friends of I.U.P.N. will enable them to join this organization as members, or contribute to the work of the Union through it. A second proposal was for an international contest for selection of an emblem for the Union, for which a prize of $250 will be offered. Details of both of the programs will be announced soon. Information will be available from the Commission on Public Information, I.U.P.N., 1214 16th Street, N.W., Washington, D.C.

Contents Noted

RETURNING from the sessions of the Third General Assembly of the International Union for the Protection of Nature in Caracas, Venezuela, to a desk piled high with accumulated work, we will devote these notes this month to rather random observations. Any trip to another part of the world is bound to be stimulating, and a visit to Venezuela is certainly no exception to that rule. It was possible, of course, to visit only a part of that country, and there was no opportunity to see the great jungle valley of the Orinoco, for example. Save for a few who were able to linger on, delegates saw only the ports of entry by sea or air, Caracas, the rich lowlands around Lake Valencia, and the high fog forest of Rancho Grande National Park.

INTRODUCTION to the capital city of Caracas is spectacular, and sometimes frightening. From the airport at Maiquetia, or the nearby seaport of La Guaira, the highway climbs tortuously from sea level to more than three thousand feet elevation at Caracas. Breathtaking drops, with only rudimentary guard rails between you and eternity, loom at many hairpin turns. And the inability of the driver to keep his hands on the wheel while talking does not add to the comfort of the trip. A new highway, however, is under construction at great cost, and due to be completed in 1953. This route goes through tunnels and over chasms and will put the visitor within a twenty-minute ride of the capital.

AT PRACTICALLY every turn of the present highway, both going up and coming down, are billboards, ninety percent of them advertising products of the United States. Most of these signboards were dangerously placed at spots where the driver's every attention should be on the highway. We were informed that the billboards are to be banned from the environs of the new highway, and we sincerely hope that this is the fact. At the present, however, Yankee enterprise, which seems to supply the vast majority of Venezuelan wares, from automobiles to canned peas, is certainly evidenced by our own domestic curse of the highway billboard.

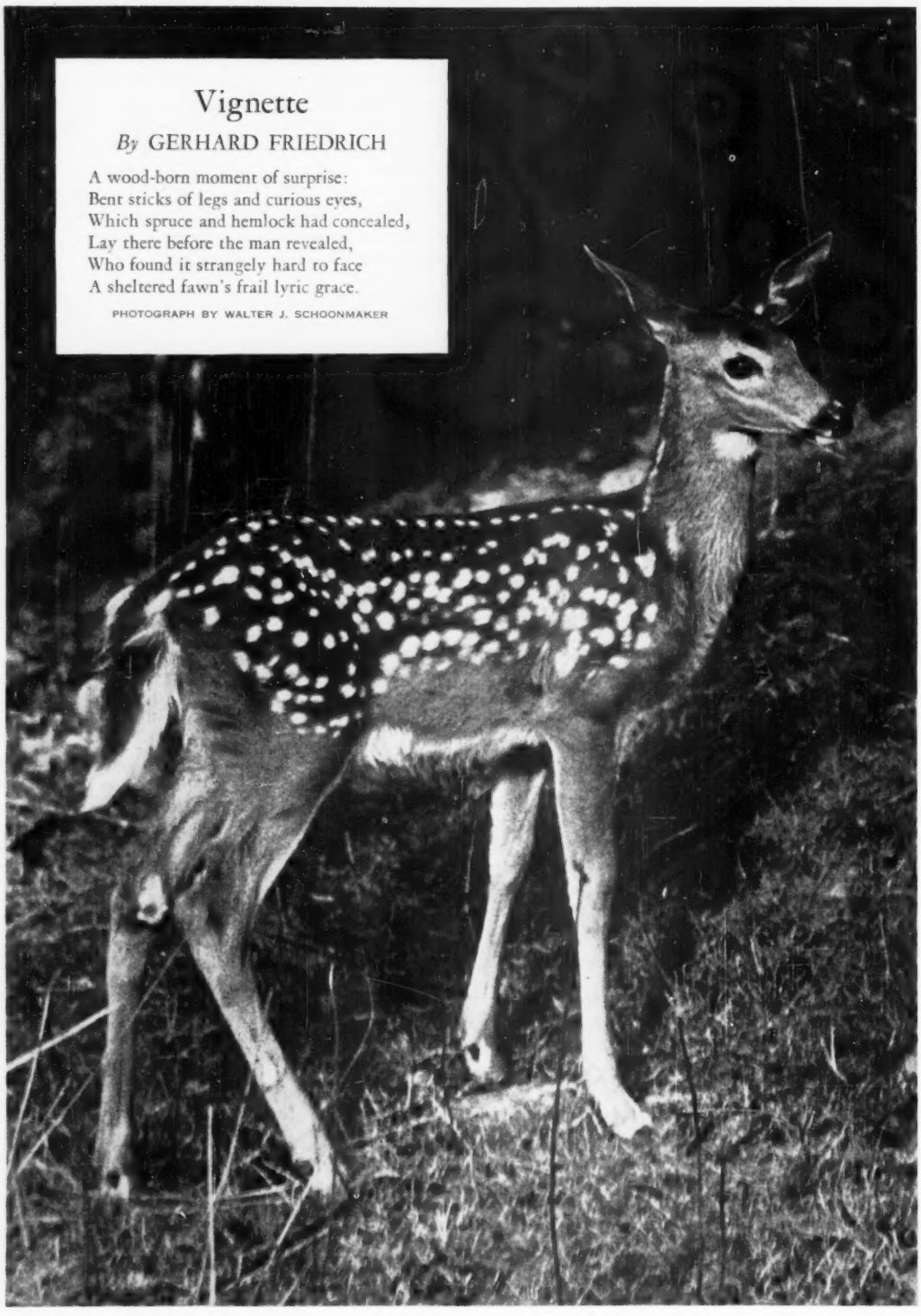
VENEZUELA is a wealthy country, thanks primarily to its natural resources of oil and ore. There is, however, a wide economic gap between those who have and those who have not. A so-called middle class is in the building, but it was estimated for us that it will take a couple of generations before it is really considerable. Caracas is spectacularly placed, with mountains rising sharply around it and habitation creeping only slightly up the foothills. It is the most expensive place we have ever encountered, apparently because wares offered in the stores are almost entirely imported and have to be trucked from ports of entry to the merchants' shelves. There is feverish building activity, with parts of the city looking like bombed London. Old buildings have been torn down, and, as a sufficiently large area is cleared, new buildings will rise. Most hotels are third or fourth rate by our standards. Meals are uniformly good but you need a fat pocketbook to eat ordinarily well. There seems to be no disposition to woo the tourist, whose dollars do not represent an important part of the economy.

MOST of the accessible mountainsides have been cut-over for timber, and there are many evidences of resulting erosion. However, the present forestry administration is doing a splendid job of restoring vegetative cover, and the hungry goats are now largely absent from the grasslands, and erosion is being checked. There is, however, a considerable amount of farming on steep hillsides, with its threat of more loss of soil. However, so much of northern Venezuela stands on end that there is not much land for horizontal planting.

THERE could not have been any more cordial hospitality than that extended to the delegates to this meeting. Not only the committee assembled by William H. Phelps, Jr., chairman of the organizing committee, worked itself into a decline, but Venezuelan officialdom extended a cordial hand of welcome. Press coverage was outstanding, and the space devoted to pictures and reports of the Assembly's deliberations could not, probably, have been equalled elsewhere.

DELEGATES visited the beautiful Rancho Grande National Park, a twenty-thousand-acre tract overlooking Lake Valencia. This park protects a primeval fog-forest and teems with wildlife and is rich in varied flora. Other park areas are under the jurisdiction of the forestry service, and there is active interest in building up a system of primeval parks while there is yet time to preserve unspoiled areas.

RANDOM memories of Venezuela: The hair-raising traffic of Caracas and the equanimity and good nature with which near-collisions were received by the drivers. . .The beautiful view of Caracas at night from the spacious terrace of the Embassy of the United States and the cordiality of Ambassador Fletcher Warren. . .The hospitality of the Venezuelan Minister of Foreign Relations at "The Yellow House," and the fascinating murals there. . .The attractive buildings of the agricultural college at Maracay, with no students in them. . .The ingenuity of the taxi drivers in finding a different route every time we went from our hotel to the meeting place of the Assembly at the Colegio de Medicos, which also lacked students. . .Grilles instead of glass in winterless Caracas. . .The rapidity with which Bolivars, known as Bs, disappeared. R.W.W.



Vignette

By GERHARD FRIEDRICH

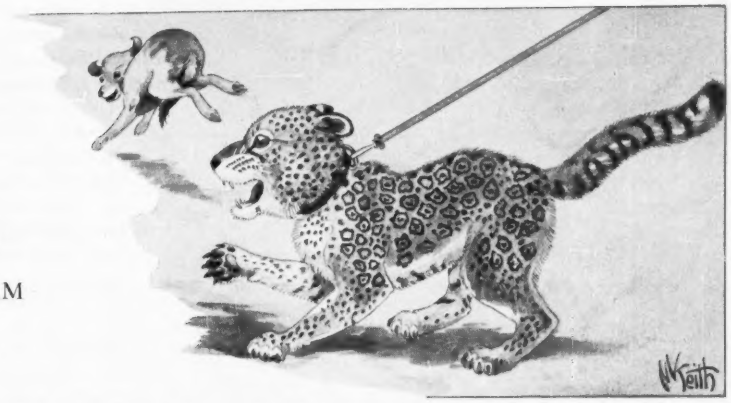
A wood-born moment of surprise:
Bent sticks of legs and curious eyes,
Which spruce and hemlock had concealed,
Lay there before the man revealed,
Who found it strangely hard to face
A sheltered fawn's frail lyric grace.

PHOTOGRAPH BY WALTER J. SCHOONMAKER

Pet Patients

By CLARENCE WILLIAM LIEB

Illustrated by Merle V. Keith



The sick little baby jaguar quickly recovered its health after proper prescription and treatment.

AS A RETIRED doctor, I have time on my hands for many hobbies. The two principal ones have always been people and animals. I believe in them — hobbies, I mean, as well as people and animals. They are good medicine. Accumulating years, plus accumulated time, need purpose and interest to keep the pendulum of life in good balance.

I am not in favor of retirement. In fact, I have written rather forcefully against it in my recent book, *Outwitting Your Years*. The pursuit of "hobby pleasure" can be just as enthralling and medicinal while working at the daily job as when one has been forced to retire from the regular routine. In my case, however, ill health made it imperative for me to stop active practice and to find other outlets for my still diligent mind and interested heart.

Liking people has always been a weakness with me. I can not exactly take a bow for that! A doctor has to like his patients in order to help them. And if he can not help them, he is not of much use in the medical profession. Human vanity, however, insists that I pat myself on the back — figuratively speaking, of course, — for ability to handle and help animals.

My list of animal friends and patients is a long and varied one. For instance there was Jag. I met Jag while on a train in South America. I had been to Peru and Bolivia to study the health and nutrition of the high Andean Indians. I had completed some of my research on the shores of Lake Titicaca and was planning to spend a few days in the Argentine.

As I left the dining car to return to my compartment, a worried-looking man approached me.

"You *are* a doctor, aren't you?" he asked.

I admitted I was. This was not the first time in my travels I had been under suspicion. To an observant eye, a man's profession leaves a trademark upon him: an aura around him. And since Sherlock Holmes showed us how, we all love to play detective. My fellow travelers have long since ceased to surprise me with their "incognito" penetration.

"I have a very sick patient in my compartment, Doctor. Would you come and see what you can do?"

I accompanied him, having first ascertained there was no practicing South American physician on the International Express. I did not want to get into trouble with the local "AMA"!

When we reached his compartment, his sister was waiting. Upon introduction I recognized her brother as a well known British author. She looked the picture of radiant health and I was a bit puzzled. She sensed my bewilderment.

"I'm not the patient," she said, smiling. "The patient is over there in that box." And within a wooden box in the corner of the tiny room there was a baby jaguar.

"We captured it three days ago," her brother told me. "Hope to take it back to the Zoo in London. The little beggar won't eat and I'm afraid he's very poorly."

The tiny creature was lying on tightly packed wet leaves, and was damp, shivering and extremely unhappy.

At that moment, we pulled into a small station, and, judging from previous stops, I knew we had enough time to do what I wished.

"Get a box from the porter," I told the brother. "Fill it with some of that hot dry sand on the other side of the platform."

He did as I asked and when he returned, Jag was soon settled in a nice dry bed with a hot water bottle for added comfort. He fell asleep immediately. His guardians and I then discussed the food question.

Baby Jag would have none of the makeshift milk conveyers such as teaspoons, saucers, eye-droppers, and glove fingers. I suspected it was the food rather than the mechanics involved that bothered him. He was still a baby and he needed his mother's milk. And mother was lying dead in a South American jungle.

Jag's needs were solved, however, by another mother. She was a fellow passenger, a South American Indian who had recently given birth to twins and was not

"Raccoons are the cleanest eaters I have ever seen; if water is available, all food must be washed clean."

averse to nursing them in public. Her generous and unaffected attitude toward Nature's demands was refreshing. She was in no way disturbed by our offer to pay an American dollar for every ounce of milk she could spare; she had plenty.

Baby was most appreciative. The milk, supplemented by cod liver oil globules and vitamin B capsules — two medicines that always accompany me on journeys — cured our patient quickly. By the time we reached Buenos Aires, he was able to walk down the station platform, pulling vigorously on his leash, defend himself against a too inquisitive dog and get his picture in the evening paper.

When I visited the London Zoo a year later, Jag was a sleek, handsome creature. And like many another patient of mine, he had forgotten all about me.

There is endless fascination in befriending animals. Aldous Huxley explains our desire to own pets as a wish to play God. He also accuses us of almost insane and hysterical gratitude toward them for this wish fulfillment. I have often thought that perhaps some of us remember the cruel wrongs done to animals, wild and tame, and our gratitude stems from the privilege to be of service to them, to be loved by them and to be forgiven by them.

The time I was allowed to be of service to a baby bear cub was a slightly humiliating experience! My wife and I were spending a holiday at a private salmon fishing camp on the Miramichi River on the Gaspe. Upon arrival, we found the camp deserted. However, the distant barking of dogs and shouting of men proclaimed excitement not far off. We were curious, dropped our belongings in the nearest cabin and hastened in the direction of the noise. We were just in time to see the shooting of a big black bear and the capture of her two cubs, who were brought back to the camp and placed in boxes for the night.

In the morning, we hurried out to inspect the two babies. The guides had put collars on them and tethered each to a stake by twenty-foot dog chains, which enabled them to have a bit of freedom and to rub noses with each other. As is always the case in different members of the same family, each cub had a distinct personality. One was surly, rebellious; the other friendly with a whimsical face and endearing manner. Their respective names were immediately bestowed — Grumpy and Cubby.

Cubby, secured by her long leash, soon became our daily walking companion. My wife fed her milk and cheese, which she loved, and brought her many oddments from the camp eating table. But Cubby was not entirely satisfied with her diet. She was unable to tell us she needed more "spinach" and I, as a physician should have guessed it. Cubby decided the matter for herself by eating generously of the coarse green grass that grew along the bank of a nearby creek.

The day arrived when we found our baby bear lying flat on her back, eyes closed, breath coming in rasping gasps and froth blowing from her open mouth. It did not take a doctor to see that she was a sick bear. But as a doctor I *did* diagnose the trouble. I knew what to do — and did it. My wife remarked I was probably the first doctor to give a bear an internal bath!

Recovery of the patient was rapid and when we left for several days fishing on the Sirvogal, we left Cubby in the best of health. When we returned, however, our baby bear was dead.

As I have said, I knew what to do and did it. What I had not stopped to figure out was the cause of her sudden attack. The excessive amount of water-grass had caused the intestinal obstruction and in her natural desire to supplement her starchy diet with necessary roughage, she had again eaten too heartily of the local spinach. This time her Park Avenue physician was not on hand to administer first aid.

We were much distressed and felt quite guilty as we looked at our friendly little forest pet. My wife, however, did her best to console me with the statement that at least Cubby had escaped a life of captivity, or a fate similar to that of her mother's.

The more pets we accumulate the more heartaches we experience. The pet that brought me the greatest

joy and the deepest sadness was a raccoon. Legend tells us that the Indian god Rama stroked a chipmunk's back and left the three streaks that are his distinctive markings. What legendary figure threw the rings around the raccoon's bushy tail? I do not know. Anyway our Smokey had them, and very decorative they were, too. His coat was the color of soft gray smoke, which added to his appeal and gave him his name.

Smokey was given to me by my wife, who brought him to me in a paper bag while I was convalescing from illness. He was tiny enough to have been put into a quart measuring glass, and was only two weeks old.

"Wherever did you find him?" I asked her. To capture a baby raccoon is an almost impossible task as their parents are exceedingly cunning in these choice of family nurseries.

"From the plumber," she replied. "He has had two grown-up raccoons in a cage for over a year and this is one of the new family."

Smokey was quite unawed by people. He loved to be handled and caressed. He was the most effective therapeutic agent I had ever encountered in my long years of dealing with illness. I was up in no time. We fed him from a bottle for a while, then he began to eat anything he could get his hands on. The dexterity and skill with which he used those hands was a marvel to behold.

Raccoons usually sleep all day and roam around at night. To convert him from a nocturnal to a diurnal member of the household took the combined efforts of myself, wife and four children and a dog. If we locked Smokey in his cage at night, he seesawed back and forth and made a terrible clatter. If we allowed him to wander around the house he became lonely and wanted the family to rouse themselves and play with him. We finally effected the required change with the help of our white Scotch terrier. Dorny and Smokey would chase each other around the place and play all day long until they were breathless. Where Dorny stopped, the children would take over, and at nine o'clock of an evening, raccoon, dog and children would call it a day.

When you have a raccoon for a household pet you own a valuable conversation piece! Whenever friends and neighbors came to call, our little exhibitionist endeared himself to all. During meals, he would go from one person to another, stand on his hind legs, firmly grasp whatever was willingly offered him, hobble to his corner and there dunk his prize in the bowl of clean water, put there for that purpose, and eat with pleasure. Raccoons are the cleanest eaters I have ever seen; if water is available all food must be washed clean.

Smokey loved chicken hearts, olives, macaroons, and many other delicacies. A caramel was his cue to raise the curtain on a circus. The sticky candy would, of course, get stuck to his teeth. He would then be the center of attention while he staged his own little vaudeville act. Applause and appreciation was a requisite to his enjoyment. Such a fat, fluffy, impeccably clean little person was Smokey. How we adored him.

"One was surly, rebellious; the other, friendly with a whimsical face and endearing manner."

Outdoors Smokey was just as companionable. He would play with dogs, but soon learned that cats were formal, conservative little individuals and demanded respectful and careful treatment. When we all went walking in the woods, Smokey would hunt out the homes of his wilder relatives and chase them out of their sanctuaries with gusto. He would wade in the water and hunt for all forms of crustacea, which he ate with great relish. Also, he soon became a most proficient fisherman. My wife had trained the fish to come to the edge of the wharf where she held fish food under the water for them to nibble on. Since my wife put her "paw" under the water and fish came to it, Smokey saw no reason why the technique should not be adopted by a raccoon. Into the water went his paw, out came a large blue-gill and Smokey had a complete fish dinner. Needless to say my tender-hearted wife never fed the fish again while Smokey was with her. From then on he was on his own and he found his fish dinners a bit harder to obtain.

"She saw a mother skunk proceeding down a narrow path into the adjoining brush followed by seven little skunks."

Now that our baby raccoon was growing to be a big boy, we had built him a cage into the corner of the garage with an outside and inside door, both of which were kept closed at night. Then came the inevitable time when one of us forgot to shut him in. A prowling Airedale thought a friendly raccoon fair game. Smokey, to whom everyone had always been kind, died a sad and violent death. For two years he had been our darling and our unhappiness was most acute. When we take it on ourselves to adopt a wild animal, we assume a responsibility incommensurate with the deed. Perhaps it was a just rebuke that our next attempt to domesticate a creature from the woodlands met with failure. Mrs. Opposum outsmarted us all.

For some time a family ambition had been to possess a baby opossum. We wanted one of the female gender, preferably pregnant, so as to have the fun of watching the raising of an opossum family. When we were living in Bedford, New York, my wife and I thought we had found our pet. We were returning home from a party and as our car rounded a curve in the road the headlights shone on an opossum sitting on a stone fence. I brought the car to a skidding stop, jumped out, slushed through a puddle in my patent leather evening pumps, leaped over the fence and grabbed the escaping animal. Upon closer inspection, however, it turned out to be a *he* and with a grunt of disappointment, I tossed my find away. My wife insists that I gave him a petulant pat on the rear before I let him go.

Some years later, however, when we had moved to California, we achieved our ambition. We had rented a house there, preparatory to purchase, complete with pigeon cote and squabs. Our mouths watered in anticipation of gastronomical treats, but someone inevitably anticipated *us*. Some marauder was always there before us.

The morning that I met the thief face to face, Mrs. Opossum was delivered into my hands. I mean that literally for in her capture I used my well-known opossum-catching method that I had learned from watching our Scottie. In case you are interested, this is how it is done. Divert the attention of the animal with your left hand, make a quick lunge with your right and hold him by the back of the neck. Opossums' teeth are long, sharp and dirty, and will give you a nasty bite if you do not follow carefully Scottie's tested technique. And that famous, well-feigned death scene they stage does not last forever!

To our surprise, and presumably as a reward for losing our squabs, we found I had captured not one opossum, but ten. Clinging to her back with prehensile tails entwined in Mother's ratlike one, hanging like little bells, were nine baby opossums. They were about the size of a mouse and absolute replicas of their parent.

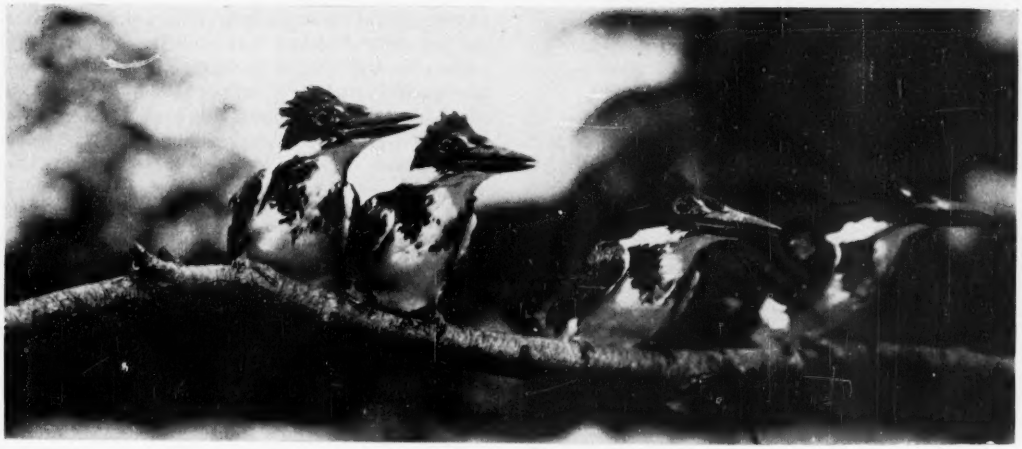
The entire family showed little concern at being captured. Within a few days the mother began to eat from my hand. But if I attempted any such liberties with her babies, she would open her ugly mouth and threaten me with dire punishment. My plan was to get her as tame as possible and then begin an intensive study of her habits and personality, complete with photographic record.

We built a special house for our new family and all went well for quite a while. Then the time came when the little house was found to be empty. Mother had gone to work with her sharp teeth and gnawed a large hole in the floor through which our nine little opossums on one big opossum's back had escaped, never to be seen again by the Lieb family.

Not all our wild playmates met with disaster or ran away and left us. Our pet skunk lived a long and happy life with us. Schmelling really belonged to our youngest daughter, Peg. Returning from the tennis court, she saw a mother skunk proceeding down a narrow path into the adjoining brush, followed by seven little skunks. With the characteristic, but often rash courage of the young, she placed her tennis racquet over the last little skunk in the line. Then she successfully transferred it to the inside of her sweater. Whereupon an outraged mother sprayed my daughter promptly and thoroughly.

A few minutes later, it was a very odorous young lady who burst into my study, dropped her "catch" into my lap and ran with all haste to the nearby lake into which she went head first with all her clothes on.

Schmelling was about the size of a three-weeks' old kitten, bright-eyed and friendly. He lived in the house with us, ate, slept, and frolicked with the dogs and cats. As he grew older, however, a faint but familiar smell would reach us whenever his playmates mauled him a bit too roughly. And whenever a stranger came into the house, he was greeted (Continued on page 498)



A family of nestling Amazon kingfishers. At the age of twenty-four days they are clad in handsome plumage, dark green and white, and much resemble their mother. They left the nest five days after they were photographed.

Kingfishers — Sovereigns of the Watercourses

By ALEXANDER F. SKUTCH

Photographs by the Author

THE KINGFISHERS long ago won a worldwide kingdom, which they continue to rule without fear of usurpation. Their ancient family has split into many branches, which divide among themselves the sovereignty of a large share of the world's waterways, in Asia, Europe and Africa, in America North and South, in the island continent of Australia, and in many lesser islands of the oceans. Their realm includes the mighty floods of the Amazon, the Mississippi, the Congo, and the Ganges, no less than infant streams across which a man can leap; it comprises brackish estuaries and arms of the sea, as well as mountain brooks of the purest sparkling water. Our watercourses would seem solitary and forlorn without their kingfishers, flying swiftly along in a business-like manner as though hurrying to keep an important appointment, or resting motionless and intent upon a bough that overhangs some deeper pool, as if time were of no consequence to them.

The kingfishers hold their empire so securely because they are admirably adapted to it, both in structure and behavior. Their strong wings carry them swiftly up and down their long, narrow domain, which they usually patrol flying low above the water and following every twist and turn of the channel. Occasionally some kinds, like the big ringed kingfisher, *Ceryle torquata*, rise high into the air and take a direct overland course from pool to favorite pool. Their stout, compact bodies are built for plunging beneath the water's surface; their bills, long, stout, straight and sharp-pointed, take a firm grasp on their finny victims. Their dense, well-oiled plumage is impervious to the water, which after each immersion they shake off in a silvery spray. Their short legs are of little use for walking or hopping; but except to waddle in and out of their long nest-burrows, these aquatic birds have no occasion to travel over the ground. One toe is directed backward. The three forward-pointing toes are partially joined together — the outer two for more than half their length — as in the related motmots.

On narrow waterways kingfishers plunge for their minnows from the overhanging bough whence they have been patiently scrutinizing the pool beneath them; or the smaller kinds may dart in from a boulder rising above the channel. But if the river or lake is broad, the larger kingfishers often hover high in the air on rapidly beating wings until they have sighted their victim, then plunge arrow-like into the depths — a thrilling sight! Like other fishermen, they are not invariably successful in making a catch; and I have seen them try again and again before they emerged with something in their bill. When caught, the fish is carried to a convenient perch, against which it is beaten by strong sidewards strokes of the bird's beak until its

struggles cease. Then it is swallowed, always head-first; for in this position the kingfisher is less likely to injure its throat or gullet with the sharp spines in the fins.

Although small fish comprise the bulk of the diet of the typical aquatic species of kingfishers, they do not disdain food of other sorts. If their stream dries up or there is a shortage of minnows, they may depend upon such food as they can capture on the land. The diet of the belted kingfisher, *Ceryle alcyon*, as reported by A. C. Bent, includes "crabs, crayfishes, mussels, lizards, frogs, toads, small snakes, turtles, grasshoppers, locusts, crickets, salamanders, newts, butterflies, moths, beetles and other insects, young birds, mice, and even berries." Some of the kingfishers of the Old World Tropics are forest-dwellers rather than haunters of streams, and subsist upon reptiles, insects, and other food they find in an exclusively woodland region.

Young ringed kingfisher, 29 days old and almost ready to fly. This largest kingfisher of the Western Hemisphere is blue-gray with white spots on the upper plumage. About the neck is a broad white collar, and the under plumage is rich chestnut. This species is widespread in tropical America and a rare straggler in southern Texas.

Kingfishers hold their watery realm so securely because, on the whole, they have little competition from birds of other families. They are highly specialized monopolists whose firm grasp on the inland waters has never been seriously threatened by feathered competitors. The oceans and their bays are fished by a multitude of birds, mostly bigger than the kingfishers. On broad, deep rivers, estuaries, bays, and ponds, there are terns, grebes, mergansers, ospreys, cormorants, and other excellent fishers. But on narrow brooks flowing through field and forest, and above all on tumultuous mountain streams whose hurrying, foaming waters pause only here and there in rock-rimmed pools haunted by wary fishes, the kingfishers rule supreme. The mountain torrent that flows by my house in Costa Rica is patrolled by three kinds of kingfishers, which reside here throughout the year. The only other avian fisher is the Brazilian cormorant, which, when not engaged in nesting, comes up from the coast, rests on outjutting boulders, and dives into the rushing current for fish. Higher up in the mountains the dipper immerses itself in pursuit of tiny fish that would be disdained by kingfishers. Otherwise the kingfishers have the river to themselves; and this is typical of mountain streams over much of both of the American continents.

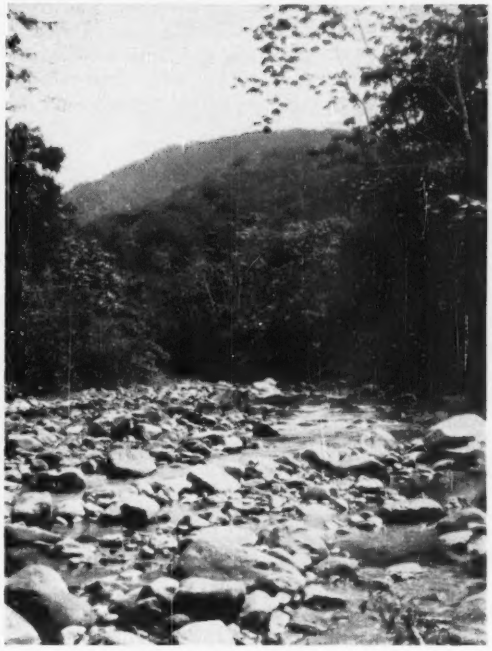
The kingfisher of Europe and the British Isles, which gave its name to the entire family, is a short-tailed bird not much bigger than the English sparrow. One wonders how so small a bird won for itself the title of *king*. Doubtless this name was bestowed in part because of the elegance of its plumage — metallic blue, green, chestnut, and white — and in part because of its regal way of carrying off small fry from the rivers. Some of the kingfishers of the Old World Tropics, especially those of the East Indian Archipelago, are resplendent creatures, clad in such brilliant colors that they are among the world's most beautiful birds.

Of the approximately ninety species of kingfishers, only six belong to the New World. One of these, the highly migratory belted kingfisher, nests as far north as Canada and Alaska. Another, the green kingfisher, *Chloroceryle americana*, breeds along the southern border of the United States. A third, the ringed kingfisher, is on rare occasions met in the valley of the Rio Grande. Our New World kingfishers range in size from the tiny but elegant least green, *Chloroceryle aenea*, only five inches long, to the imposing ringed kingfisher, fifteen inches in length. Although not so gorgeous as some of their Old World relatives, our American kingfishers are handsome, crested birds. The big kingfishers of the genus *Ceryle*, which includes the belted kingfisher, are blue-gray spotted with white on back and wings, white and chestnut on the under parts. The smaller birds of the genus *Chloroceryle* are metallic bronze-green spotted with white on the upper plumage, white and chestnut or rufous or orange-tawny below. The sexes are unlike in plumage; and in all but one of the American species the more colorful male has a greater area of chestnut or rufous on his under parts than the female, who may be quite lacking in this color. In the migratory belted kingfisher, strangely enough, the female alone wears chestnut on her breast. The mark of sex has been reversed!

Kingfishers are no more musical than their relatives the motmots. Common utterances of the belted kingfisher and its close relation, the ringed kingfisher, are a loud *kleck* and a resounding rattle. In the smaller American kingfishers, as the least kingfisher, the rattle is reduced to a low ticking, at times hardly more than a buzz. The Amazon kingfisher, *Chloroceryle amazona*, has a more musical voice, yet could hardly be called a sweet songster. Its call sounds like *joy—joy—joy*

joy—joy—joy—joy, the clear notes first rising, then falling in pitch. But of the British kingfisher Coward states: "From February onwards the male has a sweet trilling song, a modulated repetition of many whistles."

Although the kingfisher's nest is typically in a burrow in the earth, numerous other sites have been reported. The forest-dwelling kingfishers of the Old World breed in holes in trees. Even the American belted kingfisher, usually a nester in banks, may on occasion lay its eggs in cavities in dead trees and stubs. This condition is most likely to prevail in low-lying regions where extensive swamps interrupted by canals or ponds provide an abundance of food, but suitable banks are lacking. Since the kingfishers can not, like woodpeckers, carve into soft wood, if a ready-made cavity can not be found, the eggs may be hatched and the young reared on the top of a stump, which provides little shelter or concealment. According to Hume, the kingfisher of the Nicobar Islands in the Indian Ocean breeds in a chamber dug into the center of a big termites' nest attached to the trunk of a large tree or coco palm, from four to twenty feet above the ground. The hard nests of termites are in various parts of the world also used as nest sites by trogons, puff-birds, parrots, and other birds. Ledges and niches on rocky banks and cliffs may serve as sites for the nests of kingfishers that can find no convenient bank for burrowing.



Mountain stream in Honduras, home of Amazon and green kingfishers.

A vertical bank of stream or lake, not too hard or rocky, is the preferred nesting site of kingfishers; but if the shores of their fishing area are low and bankless, the birds may go far from water to take advantage of a suitable earthy wall: the cut bank of railroad or highway, the side of a gravel pit, or a steep slope in a sand dune. The length and diameter of the burrow varies with the kind of kingfisher: and with a single species the length also varies greatly with the character of the soil and the obstacles it opposes to digging. It tends to be longest in banks of sand or soft loam, shortest in hard clay or stony soil. The belted kingfisher's burrow may be as much as fifteen feet in length, although from three to six feet is more usual. Where they meet no obstacles, such as roots or rocks, kingfishers dig a nearly straight tunnel, with just sufficient curvature to make the nest at the end invisible to one looking in at the mouth. In stony soil, the burrow may have several sharp twists and turns. Nearly uniform in diameter for most of its length, at the inner end it widens into a low-vaulted chamber where the eggs are laid. In rocky banks where digging is difficult, the kingfishers may use the same burrow year after year; as happened with a pair of Amazon kingfishers nesting beside the river in front of my house. In low, sandy banks subject to erosion, they usually dig a fresh tunnel each year.

Young green kingfishers, ready to leave their burrow in the bank of a Guatemalan river. This tropical species reaches the southern border of the United States in the valley of the Rio Grande.

Kingfishers are monogamous, and male and female share rather equally all the domestic cares. Once, in Guatemala, I watched a pair of big ringed kingfishers excavate their burrow in a low, sandy, riverside bank at the edge of a banana plantation. Male and female took turns, each working inside for about four or five minutes, while the mate rested close by,

uttering from time to time a harsh *kleck*, which was answered by the other, hidden in the ground. The earth at the head of the shaft was apparently loosened by the birds' big, strong bills. I never saw them come to the entrance for the special purpose of pushing out the loose material. But each time one went in for a spell of digging it kicked back vigorously, using its legs alternately, and sending outward a double jet of sand. Doubtless the kingfisher continued this backward kicking as it shuffled up to the head of excavation, and thus the earth loosened by the bill on previous visits was gradually pushed out of the tunnel.

Nestling Amazon kingfisher, nine days old, its eyes already open and its pin-feathers pushing out.

The kingfishers of the New World apparently never line their nests with soft material, but lay their eggs directly upon the bare earth at the back of the burrow. There are reports of grass and leaves being found in their nests; but such material was probably carried in by hopeful swallows, which often investigate kingfishers' burrows before the digging is finished, and take possession for nesting as soon as the young kingfishers fly forth. Some of the Indian kingfishers are said to make nests of moss at the ends of their burrows.

Kingfishers' eggs are pure white and blunt at the ends, often nearly round in outline. In the United States the belted kingfisher lays sets of from four to eight eggs. The British kingfisher produces six, seven, or more in a set. But, as in so many other families of birds, tropical species lay fewer, usually between three and five in Central America. In both North and Central America, a single brood is raised each year.

As they shared the work of making the burrow, so male and female kingfisher divide the task of incubation. With a pair of Amazon kingfishers that I studied in Guatemala, the female covered the eggs each night; but the male was responsible for the nest most of the day. Arriving at about seven o'clock in the morning, he would, with a low *ket ket*, call forth his mate, who had been on duty since the preceding evening, then enter the burrow for a session of two or three hours. The remainder of the morning was taken up with shorter shifts on the eggs by both sexes. The male then incubated for most or all of the afternoon. One day he sat for nearly four hours; but the next day he entered the burrow at 11:40 a.m. and stayed at his task for six hours and five minutes without interruption. The female came to relieve him at about sunset. This left him little daylight to fish for his supper; and sometimes I saw him plunging for fish in the dusk, after other diurnal birds had gone to rest.

A pair of green kingfishers arranged their periods on the eggs much in the fashion of their larger relatives the Amazon kingfishers, the female taking charge by night, the two alternately through the day. A pair of half-collared kingfishers, *Alcedo semitorquata*, which R. E. Moreau studied in tropical Africa, had a rather similar schedule of incubation, but with more frequent shifts. The parents shared the work about equally, sitting usually an hour or two at a stretch, and performing their task so faithfully that the eggs were left uncovered less than ten percent of the time. But a pair of ringed kingfishers to which I gave much attention had a quite different pattern of incubation, and one rare among birds. They alternated in the burrow once in twenty-four hours, so that one day and night the male was on the eggs, and the next day and night the female was solely responsible for keeping them warm. They replaced each other every morning, between seven and ten o'clock. Each afternoon the incubating partner broke its long and solitary session in the dark burrow, emerging for a recess that lasted from half an hour to an hour, while the eggs remained unattended. What patience they had!

Kingfishers are devoted to their nests. In burrows that I had prepared for study by making an opening at the rear of the nest-chamber, they would sometimes sit resolutely on their eggs or newly hatched young while I uncovered the opening and touched them with my finger-tips. Sometimes I could even pick them up. My private entranceway was, of course, carefully closed and concealed after each visit of inspection, lest marauders take advantage of it to harm the nest. During the course of incubation the indigestible fish-scales regurgitated by the sitting birds accumulate in the nest and are compacted into a hard layer beneath the eggs. It is most difficult to learn the period of incubation of kingfishers; for they usually desert if their burrow is opened for inspection before incubation has begun. But at one fortunate nest of the Amazon kingfisher, I was able to determine the dates when the eggs were laid. These eggs hatched twenty-two days after the last of the set of three was deposited.

Newly hatched kingfishers bear not a trace of down upon their tender, pink, translucent skin. Two black bumps, projecting above the forehead, indicate the points where the sightless eyes lie hidden beneath the skin. The tip of the lower mandible projects beyond that of the upper, giving them undershot jaws. Decidedly they are not pretty babies! Soon after hatching they can stand and even toddle about unsteadily, supporting themselves on the (Continued on page 500)

The Careers of the Eucalypts

By ADELINE B. RANKIN

Eucalyptus trees have proved their value for highway plantings and as windbreaks. These are *Eucalyptus rostrata* in the Sacramento Valley.

COMMERCIALLY, eucalyptus trees have proved a sad failure in the United States; in other ways they have become invaluable.

In its native Australia, eucalyptus timber has been used for boat, bridge and building construction, railroad ties, wharf piling, telegraph poles, and fence posts. Indeed, the list of uses seems practically endless, and finally includes fuel. All of the species yield a volatile oil, some of which is useful for medicinal purposes. Tannin and kino are derived from some barks; others provide a strong material for twine. The trees bloom profusely, some species almost continuously, so they are valuable as bee trees. And the pulp has been used in paper manufacture.

However, in the United States, the boom in eucalyptus about the turn of the century, did not live up to promoters' promises of immediate financial returns to be gained from plantations of these trees.

The history of the discovery of, immediate interest in, and rapid spread of eucalyptus trees is fascinating. According to leaf remains, the eucalyptus dates back to Eocene times, when it grew in other places than Australia, physically our oldest continent and the only place where eucalyptus trees seem to have grown wild since the Ice Ages.

The closest living relative is the *Angophora* genus, which possesses petals and sepals instead of an operculum to protect immature blossoms. Eucalyptuses belong to the Myrtle family, which also includes the guava, allspice and clove trees.

Eucalyptus trees were brought to the attention of the "civilized" world by William Anderson, naturalist, and his assistant, David Nelson, when they returned from Captain Cook's Third Expedition into the Pacific Ocean in 1777. Anderson used the generic name "Aromadendron" to distinguish these trees, and it is true that all Eucalyptus have a distinct aroma. The scent varies greatly, as is implied by the common names "Apple Scented Gum," *E. stuartiana*, "Lemon Scented Gum," *E. citriodora*, and "Peppermint Gum," *E. amygdalina*.

But L'Heretier, the French botanist who studied the specimens brought from Australia by the naturalists, gave the genus its permanent name in 1788. *Eucalyptus* is derived from two Greek words, *eu*, "well" or "good," and *kalypto*, "to cover," as with a lid, and refers to the *operculum*. The *operculum* is the lid which tightly covers the blossoms until the flowers are ready to open. Then the lid is thrown off, and the reproductive organs are exposed for fertilization. Although the opercula vary widely in size, shape, and character, they are always present in the genus *Eucalyptus*.

In 1814, a generic name of *Eudesmia* was coined by Robert Brown, but the name originated by L'Heretier was already too well-known to be replaced by Brown's choice.

At first the operculum was selected as the distinguishable characteristic of different species, but this proved far from satisfactory. Then Dr. Bentham devised an elaborate system of "morphology of anthers."

Later Baron von Mueller, who named many of the species, tried to classify them by the bark. There are six types of bark — smooth, box-like, wrinkled, stringy, ironbark, and scaly. As field knowledge increased, this system likewise fell into disrepute — for the same species of eucalyptus may grow a different kind of bark under different soil and climatic conditions!

Another recent method of classification is by analyzing oil distilled from the leaves, for the oil from each species is unique to its species. The tannin and kino (often called gum) from the bark are also analyzed.

Tests by botanists, chemists, physicists, and geologists may be required correctly to determine the species, wrote Russell Grimwade, in his beautifully illustrated *Anthography of the Eucalypts*, published in Australia in

1920. Grimwade also repeated the statement, credited to "a satirist," that "classification can only be made alphabetically."

In any event, bark, leaves, flowers and fruit are necessary to arrive at even tentative identification, and several "Keys to Eucalyptus Identification" for various parts of the world have been evolved.

Despite the difficulties, more than 300 species of eucalyptus have been classified. This large number is perhaps easier to comprehend when we realize that the area of Australia is 800 square miles greater than that of the United States, and eucalypts comprised three-fourths of the virgin forests. (In his *Green Glory*, published in 1949, Baker graphically describes the destruction of miles of these glorious trees to create acres of farming land.)

Accordingly, the trees have grown in marshy lowlands, in arid deserts, at sea coasts, and at elevations as high (rarely) as 5000 feet; on fertile loam, and on otherwise barren rocky and alkali soil. Hence some species are midgets, known as *mallees*, growing sometimes only two feet tall, but usually are taller than man. Other species are giants, well over 300 feet high, their height being exceeded nowhere in the world except by the elderly sequoias of California. Some accounts state, however, that *E. regnans*, tallest of the trees, have towered higher than the Founder's Tree of the Coast Sequoias, rated as the tallest tree in the world.

However, out of their native habitat, eucalyptus trees seldom grow taller than 200 feet. Perhaps this may be partially explained by their relative youth, for the mightiest Australian trees were no doubt hundreds of years old.

E. globulus was introduced into Europe, Asia, Africa, and the Americas in the early 1850's, partly through the efforts of Baron von Mueller, who was director of the Botanical Gardens at Melbourne for sixteen years. This species has been planted throughout the world to a greater extent, it is believed, than all other species combined, and it is one of the most easily recognized of the genus.

Commonly called "Blue Gum," this tree rapidly grows tall, with the lower branches high off the ground. Its light-colored, smooth bark is usually deciduous, peeling off in long shreds throughout the year. The long evergreen leaves, from six to thirteen inches, are grayish-green and of leathery texture, more or less lanceolate or sickle-shaped. The flowers and seed cases are large, three-fourths to one inch in diameter. The trees have a distinct, although not particularly pleasing, odor. *E. globulus* will grow at temperatures ranging from 27 to 115 F., and withstands quick temperature changes better than any other eucalyptus, although none of the genus may be said to *thrive* under rapid changes or extremes of temperature.

Closeup of the leaves and unopened buds of *Eucalyptus rostrata*.

According to the U.S. Forest Service, the first eucalyptus trees in California were planted by a Mr. Walker at San Francisco in 1853. Bancroft states that the first blue gum plantation was started in Castro Valley in 1869. Other sources say the first eucalyptus plantations were of various species and planted by Ellwood Cooper, near Santa Barbara, in 1872 and succeeding years. Cooper urged further plantings by spoken and published lectures, and apparently profited from his early groves.

From 1890 to 1910, planting of eucalypts throughout the southern states, and particularly in California, boomed. It has been estimated that 50,000 acres of the trees were under cultivation at the same time in California alone.

Owners of the groves expected to make a quick profit from the trees. Was not the timber valuable? The trees quickly grew to firewood size! The oil was suitable for various medicines!

But the plantations did not work out as a get-rich-quick scheme. It is true that many of the trees grew fast, but some planters had chosen species not adapted to their particular requirements.

The uses for eucalyptus wood were diminishing. Wood was on its way out as a primary fuel. Metal was replacing eucalyptus wood in construction of many articles.

Then came a big sticker. Lumber operators could not shove the timber through drying kilns in a few weeks. In order to be seasoned properly, the lumber took two years of air drying, and the ends checked

An excellent example of a thick windbreak of eucalyptus near Napa, California. They protect many citrus groves from damage by high winds.

enough to necessitate recutting. Some species required different treatment from others. Some just were not satisfactory for hardwood lumber.

Then came another blow — eucalyptus oil meeting U. S. pharmaceutical standards was obtainable cheaper by import from Australia. Fortunately few had invested in steam distillation equipment.

So the eucalyptus fell from favor as a commercial tree. But its success in windbreak and highway plantings became noticeable. In the southern part of California, alone, there are now 2000 miles of eucalyptus windbreaks protecting citrus orchards. Woodbridge Metcalf, Extension Forester for the University of California College of Agriculture, cites this figure in his booklet, "Eucalyptus Serves Many Purposes." There is no way to estimate how many thousands, perhaps millions, of dollars eucalyptus trees have saved for farmers by protecting their citrus and avocado orchards from wind damage.

For highway planting, the hardiest species have been used by the California State Division of Highways, because after a year or two of irrigation care the trees require no further attention. One of these species is *E. rostrata*, or red gum, which Baron von Mueller called "perhaps the most important of the whole genus." Every part of the tree was used to advantage in Australia — for timber, for fuel, as a source of honey and shade, for windbreaks, and as forest cover. The red gum will grow on moist coast or dry mesalands, in the foothills and interior valleys. It will endure considerable heat, frost and drought, and tolerates quite alkali soil. The specific name derives from the Latin, *rostratus*, "beaked," because the operculum is distinctly pointed or beaked. This and *E. sideroxylon*, iron bark, were the only species of eucalyptus made available to the public at cost by California State Nursery in 1951.

Eucalypts are returning to favor in California as the reasons for their commercial failure, and as their success as windbreak and erosion control trees are becoming manifest. It has been stated that seventy-five species have been grown in California, twenty-three with comparative success, and ten with very good results.

In other parts of the United States the trees were never planted as extensively as in California. In the Southwest, eucalyptus have been planted mainly as ornamental or shade trees. In the central and eastern parts of the South, heavy frosts, which occur sporadically, have periodically killed many of the trees. Then, too, it was found that where southern pines or hardwoods grew naturally, the eucalyptus were usually less hardy, less valuable, and not much, if any, faster in growth.

But one fact is notable; although eucalyptus trees grew nowhere except in Australia and Tasmania a hundred years ago, now they are grown throughout the temperate world. If for no other reason, they are enjoyed as exotic park and avenue trees. For, whether they be tall and stately, or graceful and weepy foliaged, or bushy and shrublike, the leaves of the eucalyptus are abundant all year, their blossoms beautiful to see!

Ornamental *By* BERYL STEWART

Goldfinches . . .
Fancy bright buttons
For God's Go-To-Meeting vest.

Crouching low over her nest, the pheasant-tailed jacana of Kashmir presses an egg against her breast with her beak preparatory to moving to a new location.

The Pheasant-Tailed Jacana in Kashmir

By C. L. BOYLE

The interesting article on the jacana in Africa. (Feb. 1952) results in this account of the bird in another part of the world by Colonel Boyle, Secretary of the Fauna Preservation Society of England.

When the Sind River debouches out of the mountains surrounding the Vale of Kashmir, it branches into many channels, all of which eventually join Jhelum, one of the five great rivers of Punjab. Here is formed the large, shallow, weedy Anchar Lake, a breeding place for one of the Asiatic members of the Jacana family, *Hydrophasianus chirurgus*, the pheasant-tailed jacana. This bird, as it flies low over the water, is remarkable for its pied plumage and its cat-like, mewing call.

To photograph the pheasant-tailed jacana, my hide, or blind, was placed on a small raft of planks lashed to long poles. Sitting in the hide I was about twelve feet from the four lovely, shining, bronze-colored eggs. Soon the hen jacana approached, smartly clad in chocolate and white with golden nape. She came walking, her long toes taking advantage of every piece of floating water weed. Then, thirty feet in front of me, she stopped and started placing together a few pieces of reed. Unfortunately I missed her first visit to her eggs, and when I looked up she was occupied with bits of reed once more — but there were now only three eggs in front of me. Then I realized that the jacana had found the near presence of my hide intolerable, had quickly twisted a new nest together and was moving her eggs one by one to it.

Soon she came again and crouching over her first nest, pressed an egg against her breast with her bill. Then, without lifting the egg, and still crouching, she walked backwards over the lily leaves until she had manoeuvred the egg into the new and more distant position. She dealt similarly with the third egg, but when she came to fetch the fourth the click of my shutter frightened her and away she went.

She was absent about twenty minutes and then I saw her apparently sitting on her new nest. I wondered whether she would leave her last egg, or perhaps not even know that the fourth had still to be moved. However she came for it sure enough. That shows, thought I, that the jacana can count (Continued on page 498)

Charles Lucien Bonaparte — Student Prince of Natural History

By ROMEO MANSUETI

DURING the formative years of scientific growth in America, several important Europeans volunteered a hand in furthering research studies in the New World's natural history. Among them, however, few could compare with a famous, yet little known scientific genius, a nephew of Napoleon Bonaparte.

Charles Lucien Jules Laurent Bonaparte — a name that bespeaks the "Old World man of distinction" — was figuratively born with a silver spoon in his mouth. Far from being a proverbial prince living the typical luxurious life of a court, he spent most of his time in the laboratory, the field, or the library. Of Italian-French blood, and officially Prince of Canino and Prince of Musignano in Italy, this gentleman became one of the most astute scholars in all Europe. Truly the title "Student Prince of Natural History" fits him well.

People who have not heard of the "American Bonaparte" immediately recognize his name when spoken in the same breath with America's pioneer ornithologist, Alexander Wilson. As a result of his researches on American birds, William Howard Ball and Theodore Sherman Palmer, two of our most distinguished taxonomists, paid an important tribute to the Prince when they called him the "Father of American Systematic Ornithology." He earned this title mostly by the publication of a continuation of Alexander Wilson's *American Ornithology*. These four volumes always associate his name with that of Wilson, although the latter died when the Prince was a lad of ten years and had not yet set foot in America.

The story of the Student Prince, for all his labors on American birds, is little known, and far from romantic in the sense of a prince charming. Rather it is a story of zeal, enthusiasm, and selfless labors in the zoological realm at a time when only the eccentrics and professors practiced such foolishness with the animate Nature. Although Bonaparte's writings are widely quoted, he has managed to tack a veil of secrecy about his personal life. This was partly explained by Spencer Trotter in *Cassinia*. "Here is one whose name conjures up the thought of empire and the pageant of war, whose joy in life was far removed from such vainglories. To most minds there is but [one] Bonaparte. As a young ornithologist I used to connect the name Bonaparte's gull with that of *Le Petit Caporal* and it was somewhat of a surprise, one of those agreeable surprises, to find that a near kinsman of the Emperor was an ornithologist."

Charles Lucien Jules Laurent Bonaparte, 1803 to 1857, nephew of Napoleon Bonaparte and Italian-French ornithologist who so affected the systematics of American birds that he is called the "Father of American Systematic Ornithology."

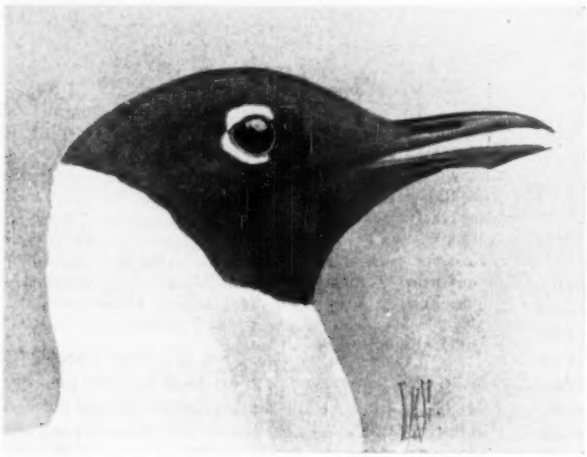
The Prince was the oldest son of Lucien Bonaparte, brother of Napoleon. He was born in Paris on May 24, 1803. In later life neither father nor son seemed imbued with the lust for power that characterized the emperor. After the Prince settled in Italy he became more or less active in certain reform movements. His father was a man of scientific and literary attainments and was active in French politics during the Emperor's prosperity.

The Student Prince was officially made "Prince of Canino" and "Prince of Musignano" in 1814 by Pope Pius VII. Joseph Bonaparte, elder brother of Napoleon and Lucien, fled to America after Waterloo and settled at Bordentown, New Jersey, then in Philadelphia. Ornithologist Charles joined his uncle Joseph, who was once King of Spain, probably about 1822, and married his first cousin, Zenaide, the eldest daughter of Joseph. Charles Lucien Bonaparte is occasionally confused with Charles Joseph Bonaparte, the son of Jerome Bonaparte, King of Westphalia, and Elizabeth Patterson of Baltimore. Charles Joseph graduated from Harvard Law School in 1874 and became an important personality in American affairs at the close of the 19th century.

In 1825, Princeton University conferred the honorary degree of Master of Arts upon Charles Lucien Bonaparte, although he apparently never attended the college as a student. He left the United States in 1827.

During the interim of five years he had accomplished a prodigious amount of work on the avifauna of North America. In 1828 he moved to Italy where, in 1848, he became a leader of the Republican party in Rome, and was chosen vice-president of the constituent assembly in 1849. After the occupation of Rome by French troops, he returned to France, but was expelled by order of Louis Bonaparte.

As a resident of Italy following his return to Europe he devoted the remainder of his life to scientific, mainly ornithological, pursuits. Later in life (1850) he was permitted to return to Paris, where after four years he was made a director of the Mecca of natural history of that era — the Jardin des Plantes. He died on July 29, 1857, at the age of 54. He left a number of children, none of whom became a naturalist. Some time ago



Named *Larus philadelphia* by George Ord, the popular name for this bird is Bonaparte's gull. Its coast-to-coast range in North America seems to typify the great affect of Bonaparte on ornithology in America.

several ornithologists became quite interested in the location of his remains, and after extensive detective work it was discovered that he is now buried at Bonaparte Chapel at Ajaccio, Corsica.

No less an individual than our beloved Audubon left us with a visual picture of the Prince. He recorded his impressions in 1827 after seeing Bonaparte in London. "His fine head was not altered, his mustachios, his beard, his keen eyes, all was the same." Backwoodsman Audubon, while visiting Bonaparte at his lodging, was surprised to hear the servant address the latter as "Your Royal Highness." Audubon reflected, "I thought this ridiculous in the extreme, and I cannot conceive how good Charles can bear it; though probably he *does* bear it because he *is* good Charles."

Audubon showed great respect for Bonaparte; not so much for his wealth and position, but for his almost infallible scientific integrity. Thus when the latter called upon Audubon with several gentlemen, our bird artist opened his portfolios of drawings. ". . . they saw many birds they had not dreamed of. Charles offered to name them for me and I felt happy that he should; and with a pencil he actually christened upwards of fifty, urging me to publish them at once in manuscript at the Zoological Society . . . Oh that *our* knowledge could be arranged into a solid mass."

Audubon must have become very fond of the Prince, since he wrote again on December 4, 1827: "A letter from Charles Bonaparte tells me he has decided not to reside in America, but in Florence; this I much regret." Audubon also preserved an interesting memento of the period in which he lived when he wrote: "I received a long letter from Charles Bonaparte, and perceived it had been dipped in vinegar to prevent it from introducing the plague from Italy to England."

It is significant that the ornithological triumvirate composed of Bonaparte, Audubon and Wilson, although not exactly contemporaneous with one another, should have been more or less active in and around Philadelphia, then the "scientific" center of the United States. It was there that Audubon, taking painting lessons under the artist Thomas Sully, and seeking a possible publisher for his great work, first encountered Bonaparte. He wrote; "April 10, 1824, I was introduced to the son of Lucien Bonaparte, nephew of Napoleon, a great ornithologist I was told. He remained two hours, went out, and returned with two Italian gentlemen, and their comments [upon the bird paintings] made me very contented." According to Spencer Trotter, who in 1905 prepared one of the best accounts of the Prince's life, a warm friendship sprang from this meeting, and although the two saw little of one another, many letters passed between them. Bonaparte always referred to Audubon as a "painter-naturalist."

Bonaparte's investigations flowered in the cultural atmosphere of early 19th century Philadelphia. He engaged at his own expense the energetic and artistic bird student, Titian R. Peale, to collect birds in Florida. From this expedition the Prince acquired many unusual species, among them several new genera and species. The Prince was elected a member of the Academy of Natural Sciences of Philadelphia in 1824. One year later a member, Dr. Edmund Porter, wrote that "Bonaparte . . . is a little, set, black eyed fellow, quite talkative and withal an interesting and companionable fellow. He devotes his attention to ornithology . . . [and] read a memoir on the Golden Plover. To a novice it seems curious that men of the first intellect should pay so much attention to web-footed gentry with wings."

Bonaparte's chief claim to American ornithological fame lies in his efforts to create order from the chaos of systematics of that time. He possessed the logical mind to fathom the fundamental problems of relation-

ships of birds — no mean accomplishment for a European working in our front yard. His first paper on observations on the nomenclature of Wilson's *Ornithology* displayed the correct usage of "nomenclature." The ornithological sage, Elliott Coues, declared later that it "introduced a new feature — decided changes in nomenclature resulting from the sifting and rectification of synonymy. It is here that questions of synonymy — today the bane and drudgery of the working naturalist — first acquire the prominence in the history of our special subject."

The Student Prince, just barely 21 years old, continued to astound his elder colleagues by writing his scientific contributions in three different languages, a feat that could probably be equalled only by the precocious American zoologist, Edward Drinker Cope. Bonaparte was always apologizing for his poor English, which in actuality was quite good. His knowledge of birds was cosmopolitan; he devoured books and papers about birds, written in different languages, with as much facility as the literary polyglots of the Continent.

In 1828 he published his important *The genera of North American birds, and a synopsis of the species found within the United States; and supplement.* This *Synopsis* arranged birds in systematic order for the first time. Audubon carried a copy of this work on his Labrador trip, and many other bird students acclaimed it. Bonaparte named two genera of American doves for his wife; *Zenaida*, represented by the Zenaida, and white-winged dove, and *Zenaidura*, the mourning dove, which extends across the continent.

In mapping the history of ornithology in America in 1903, Coues paid Bonaparte the compliment of designating "The Bonapartian Period, 1824-1831" as a subdivision of the "Audubonian Epoch, 1824-1844." He spoke of Bonaparte as "a princely person, [who is] destined to die one of the most famous of modern naturalists." Coues considered Wilson as the "least bookish" of men, hence he scarcely gave much attention to the importance of synonymy. Bonaparte's *American Ornithology* was uniform with Wilson's monumental work, and was originally published in four large quarto volumes, running from 1825 to 1833.

In addition to publishing many small contributions in many journals, Bonaparte published a unique comparative list of the birds of the latitude 40°, parallel of Rome and Philadelphia. Later, in 1838, he published a comparable essay on the birds of North America and Europe. Both exhibited an extraordinary knowledge of our bird species, and both were surprisingly original. They served as pioneer attempts at establishing the field of zoogeography.

Temminck's dove is called *Zenaida auriculata*, and the genus was named after Bonaparte's wife, Zenaide. This dove is found in Central and South America.

In his beloved Italy, the Student Prince gave his natural history energies full rein. There he published a magnificent three-volume folio work, between 1833 and 1841, entitled *Iconographia della Fauna Italica*. Only the works of John James Audubon, John Edward Holbrook, and Mark Catesby, in America, and John Gould in England, could rival it. The publication was resplendent with fine hand-colored plates and elaborate descriptions of the birds, mammals, reptiles, amphibians, and fishes of Italy. Nothing equal to it has been produced there to date.

Bonaparte became an indefatigable writer, exploring the whole realm of zoology. His great work, *Conspectus Avium*, published in 1850, established his name as a permanent fixture in the pillars of ornithological taxonomy. His other major contributions, brilliantly expressed in French, English, Italian, German, Dutch, and Latin, included such subjects as: Synopsis of North American mammals, Catalog of the fishes of Europe, Catalog of European birds, Monograph of

pigeons, Monograph of paroquets, Butterflies. He also wrote extensively on European amphibians, turtles, mammals, fossil birds, serpents, and many other specialized studies of vertebrate forms.

Far from being the stuffy pedant, he displayed an appreciation for humor. On one occasion he wrote about the Grand Opera in New York, stating that owing to the prevailing influenza the audience was constantly coughing and sneezing, "which supplied in a pretty awkward manner the deficiency of the instruments in the orchestra." His friendly and exuberant spirit in the field of ornithology is exemplified in a plea to his friend Dr. Hays of the Academy. "For God sake, don't throw a feather away of those East Indies birds before I have examined them. Some may prove interesting."

Dillon Ripley, the famed explorer-ornithologist, recently related how Bonaparte mixed politics and ornithology in a somewhat sardonic yet humorous fashion. Bonaparte, in describing the Wilson's bird of paradise, was tired of the fact that so many of them had been named after royalty, or at least nobility, and so decided to name his new bird after "the Republic." He went on somewhat sourly, however, to note that the Republic was somewhat less than perfect, owing to the machinations of "so-called Republicans." He concluded that "even though a paradisean Republic does not exist, at least there is now a *Paradisaea respublica*." Unfortunately, this pun of a scientific name has been demolished by a humorless taxonomist, who forced the bird of paradise to be called *Diphyllodes respublica*.

The well-to-do Prince shared his wealth as liberally as his knowledge. The Philadelphia Academy of Sciences benefited greatly from his generosity, and he assisted many naturalists and artists. He subscribed to most of the scientific journals, and also was among the first to purchase Audubon's *Birds of America*, and Holbrook's *North American Herpetology*, through subscription.

Bonaparte was inculcated with a vital and obsessive love for science. He participated in everything and was a confirmed joiner. Consequently it was natural for him to become a crusader. Few people could compare with him in his tireless efforts to create a sort of European "Scientific Union." H. S. Strickland, a well-known British ornithologist, in praising Bonaparte's monograph on Italian vertebrates, warned, "Nor let it be forgotten that he was the first to establish beyond the Alps, that great *mental*, no less than *physical* barrier, a peripatetic congress of scientific men. . ." In 1841 Bonaparte read his *Observations on the state of zoology in Europe, as regards the vertebrata* before the Italian Congress of Science in Florence. His enthusiasm and genuine sincerity fired the representatives as they have never been inflamed. They were most impressed when he urged that the "spirit of intercommunication" become the chief object of scientists in all countries.

Wilson, the man who faithfully prepared the inventory of North American birds, remains the undisputed pioneer of American ornithology. Audubon, whose handsome paintings of native birds have stirred the cockles of the shallowest of esthetic souls, is immortalized in American history. But Bonaparte, the fortunate Student Prince, the scholar who tackled and conquered all the unpleasant problems relating to American birds, hardly rates a second thought from anyone except the serious bird student. For all those who worship science, the fact that Charles Lucien Bonaparte chose to place the study of birds on a firm basis will insure him a foremost position in the American ornithological hall of fame.

What Is Magic?

By LOUISA BOYD GILE

What is the magic formula that brings
A stir to pulses when a small bird sings?
It must be deep within us — deeper than
The roots where life's first mystery began.
Only this morning (while a jet plane screamed
Its way to silence) delicate, unaware,
A hummingbird with whirring intricate wings
Spun like a jeweled arrow through the air.
More perfect and more marvelous it seemed,
This master of precision, than the fine
Instruments of destruction men design.
Somewhere in the dim past must human eyes
Have marked this feathered miracle with surprise
Before the wonder dulled — before they dreamed
Of steely wings and hideous aerial sharks
To mock the stars and drown the flutes of larks.
These are ingenious things,
But divine wonder still is only stirred
Not by incredible machines — but by a vibrant bird.

The Sky at Night

Originally published as the third in this series of educational inserts, and long unavailable separately, this insert is now republished by popular demand as the sixty-eighth in the series.

By E. LAURENCE PALMER

So much recommended star study deals either with profound mathematics or imaginary mythology that material intermediate between these extremes should be helpful.

The North Star, to the mythologist, is the end of the long tail of the little bear, Ursa Minor, but to those using the following pages it will be three stars, so far away that they appear as one; so far, in fact, that it takes light about 250 years to come from them to the earth. The North Star is a thousand times as brilliant as our sun, with magnitudes of 2.1 and 9 and with periods of 3.96 days and 11.9 years. And what, some may ask, do we mean by periods, magnitudes and light years? While it may take some imagination to understand some of these things, they are, no doubt, more easily understood than many of the mathematical formulae of the professional astronomer. We have no desire to discourage star study in all its complexity, but it is easier to remember a distance of 250 light years, for example, than a number with a regiment of zeros.

The term "light-year" of course refers to the distance light travels in a year. Light travels about 186,000 miles a second, or about 6 million million miles a year, so it is plain that if we deal with light years in such figures mathematical short cuts are helpful.

In star study we soon run into the term magnitude and one may naturally assume that this refers to size, when, as a matter of fact, it means brilliance. The beginner in astronomy must not assume that a star with a magnitude of 6 is brighter than one with a magnitude of 2, 3, or 4. In astronomy the more brilliant stars are given a magnitude of 1, and are spoken of as "first magnitude" stars. There are also stars brighter than magnitude 1, as Sirius, minus 1.6, and Canopus, minus 0.9. Less brilliant stars are given, in order of less brilliance, numerical values such as 2, 3 and 4. Stars whose magnitudes are indicated as of 6, or more, cannot be seen with the naked eye, even under the best conditions, which brings us back to the North Star, one of whose stars has a magnitude of 9. This star cannot, of course, be seen with the naked eye.

We will meet such terms as double stars and triple stars. These are simple since they refer to the actual number of stars in what appears to the eye to be only one. At a sufficient distance an automobile's headlights appear as one light, becoming two or more as the car approaches. So it is with our stars, and many who start to study stars are surprised that there are so many that are double, triple or multiple, but are near enough together to appear as one.

The term variable, of course, refers to differences in brilliance at different times, and stars are variable for a variety of reasons. Study of such stars is a special phase of the study of the heavens, and to attempt to discuss this subject in a brief paragraph would be only to confuse the reader. It is, however, something worthy of special investigation, and a splendid aid to this is *The Nature of Variable Stars* by Paul W. Merrill, a popularly-written discussion.

The next most commonly used term in the charts that follow is that of "period." This refers to the length of time required for one star to complete a revolution around another.

Use of the Remainder of This Section

The remainder of this section may be used with or without the help of a planisphere. A planisphere may be purchased separately, or may be made from the diagrams on Page 479, following the directions given.

The first two charts provide maps of the heavens as they may be seen at any time of the year over most of the United States. They include the Circumpolar Constellations. The other charts are continuations of portions of the sky as indicated on the charts of circumpolar constellations. Some of the stars in these charts may easily be seen on summer evenings, and others on winter evenings. The nature of the stars numbered in these and the other charts is explained in the text opposite each chart.

If one wishes to locate a star, or constellation, whose name is known but which is not named on the planisphere map the following star and constellation directory may be useful. In it the Roman numerals are used to indicate the chart in which the star or constellation is considered, and the Arabic number to indicate the number assigned to the individual star. Thus IX, 15 refers to star number 15 in chart IX.

Directory

Albireo, IX, 15
Alcaid, VII, 1
Alcyone, IV, 19
Aldebaran, IV, 21
Algenib, III, 13
Alhena, V, 14
Alpheratz, III, 12
Altair, IX, 29
Andromeda, III, X
Antares, VIII, 35
Aquarius, IX
Aquila, IX
Archer, IX
Arcturus, VII, 18
Aries, III
Auriga, I, IV
Beehive, V, 8
Bellatrix, IV, 24
Betelgeuse, IV, 25
Big Dipper, See Ursa Major, I, IV
Bootes, II, VII, VIII
Bull, IV
Camelopardus, I, II
Cancer, VI
Canis Major, V
Canis Minor, V
Canes Venatici, VII
Capella, IV, 1
Capricornus, IX, X
Cassiopeia, I, II, III
Castor, V, 1
Cepheus, I, II
Cetus, III
Circlet, V, 14
Coma Berenices, VIII
Cor Caroli, VII, 4

(Continued on page 480)

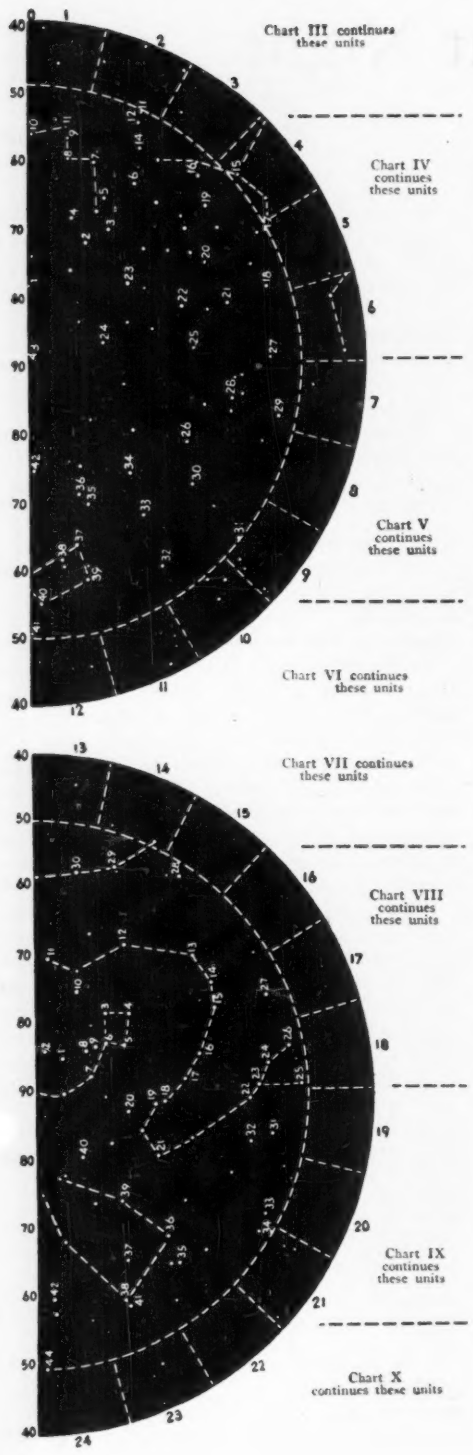


Chart III continues these units
Chart IV continues these units
Chart V continues these units
Chart VI continues these units
Chart VII continues these units
Chart VIII continues these units
Chart IX continues these units
Chart X continues these units

CHART I

POLAR CONSTELLATION CHART

CEPHEUS. Star 1, period 166.2 years.

CASSIOPEIA. Star 2, double, magnitudes, 4.7 and 7.2; period, 52.95 years; Star 3, triple, magnitudes, 4.2, 7.1, 8.1; Star 4, triple, magnitudes, 4.4, 8.9, 9.5; Star 5, magnitude, 3.4; Star 6, gold-green, double, magnitudes, 6.1, 6.6; Star 7, magnitude, 2.8; Star 8, magnitude, 2.2; Star 9, gold-red, double, magnitudes, 3.6, 7.9; period, 507.6 years; Star 10, magnitude, 2.4; distance, 5.7 light years; Star 11, Shedir, variable, magnitudes, 3.6 to 7.9; distance, 47 light years.

PERSEUS. Star 12, double spiral nebula joined with a ring; Star 13, double; periods 126.5 days, 63.2 days; Star 14, double, variable, magnitudes, 7.5 to 11 and 8; period, 320 days; Star 15, Mirfak, magnitude, 1.9; period, 4.09 days; Star 16, magnitude, 3.1; Star 17, magnitude, 4.5; period, 1.5 days.

CAMELOPARDUS, THE GIRAFFE. Star 18, double, magnitudes, 4.4, 11.3; period, 3.8 days; Star 19, double, magnitudes, 4.8, 9.2; Star 20, nebula; Star 21, magnitude, 4.7; Star 22, magnitude, 4.3; period, 7.9 days; Star 23, magnitude, 4.7; Star 24, double, magnitudes, 4.5, 8; Star 25, triple, magnitudes, 6.7, 7.9, 10.9; Star 26, triple, magnitudes, 6.2, 8, 9.2.

AURIGA. Star 27, magnitude, 2.1.

LYNX. Star 28, triple, magnitudes, 5.2, 6.1, 7.4; Star 29, variable, magnitudes, 7 to 13.8; variation period, 379.2 days.

URSA MAJOR, THE GREAT BEAR. Star 30, magnitude, 3.5; Star 31, variable, magnitudes, 8.4 to over 13; period 247 days; Star 32, double, magnitudes, 5, 5.6; period, 99.7 years; Star 33, double, magnitudes, 3.8, 9; Star 34, double, magnitudes, 5, 8; Star 35, magnitude, 4.9; period, 11.58 days; Star 36, variable, magnitudes, 7 to 13; variation period, 302 days; Star 37, Dubhe, magnitude, 2; distance, 70 light years; Star 38, double, magnitudes, 5.8, 7.1; period, 71.9 years; Star 39, magnitude, 2.4; period, .31 days; distance, 60 light years; Star 40, magnitude, 2.5; Star 41, spiral nebula.

DRACO, THE DRAGON. Star 42, double, magnitudes, 7, 8.3; period, 42 years.

URSA MINOR, THE SMALL BEAR. The polestar, Polaris, 43. This is really a triple star. The major group has a magnitude of 2.1, is yellow, has 190 light years distance and is a thousand times as brilliant as our sun. Two of the units turn around each other in a period of 3.96 days, and these in turn move about the third in a period of 11.9 years. Another unit has a magnitude of 9.

CHART II

CAMELOPARDUS, THE GIRAFFE. Star 1, variable, magnitudes, 7.9 to 13.7; variation period, 269.5 days; Star 2, double, magnitudes, 5, 6.

URSA MINOR, THE SMALL BEAR. Star 3, Kochab, the polestar in A. D. 140; magnitude, 2.2; distance, 230 light years. Stars 4, 5, 6, parts of the "little dipper"; Star 7, magnitude, 4.4; period, 39.5 days; Star 8, double, magnitudes, 7, 8; variation period, 115 years; Stars 9 and 10 variable; magnitudes over 7.

DRACO, THE DRAGON. Star 11, magnitude, 3.9; Star 12, Thuban, magnitude, 3.64; period, 51.38 days; the polestar when pyramids were built more than five thousand years ago; Star 13, magnitude, 3.5; Star 14, triple, magnitudes, 7.5, 7.7, 9; Star 15, double, magnitudes, 2.9, 8.1; Star 16, magnitude, 3.2; Star 17, magnitude, 4.87; period 5.28 days (the pole of the ecliptic is indicated by a cross almost south of this star); Star 18, double, magnitudes, 4.8, 6.5; Star 19, magnitude, 3.6; period, 281.8 days; Star 20, period, 4.12 days; Star 21, double, magnitudes, 4, 7.6; Star 22, triple, magnitudes, 4.7, 7.7, 7; Star 23, variable, magnitudes, 7.5 to 12.2; variation period, 426 days; Star 24, double, magnitudes, 4.6, 4.6; Star 25, magnitude, 2.4, distance, 74 light years; Star 26, double, magnitudes, 5, 5.1; Star 27, double, magnitudes, 5, 6.

BOOTES, THE HERDSMAN. Star 28, double, magnitudes, 4, 12.

URSA MAJOR, THE GREAT BEAR. Star 29, Mizar, the first double discovered, magnitudes, 2.1, 4.2; period, 20.23 days; distance, 80 light years; Star 30, magnitude, 1.68; 56 light years away; period, 4.15 years.

CYGNUS, THE SWAN. Star 31, double, magnitudes, 5, 9; Star 32, double, magnitudes, 6.8, 7.4; Star 33, variable, magnitudes, 15 to 1.9 in 10 days; Star 34, triple, magnitudes, 7, 9, 10.1.

CEPHEUS. Star 35, triple, magnitudes, 6.3, 7.9, 8; Star 36, magnitude, 2.6; distance, 36 light years; Star 37, double, magnitudes, 4.7, 6.5; Star 38, variable, magnitudes, 3.6 to 4.3; variation period, 5 days, 8 hours, 48 minutes; Star 39, double, magnitudes, 3, 7; period, .19 days; Star 40, variable, magnitudes, 7.9 to 13; variation period, 486 days; Star 41, double, magnitudes, 9.3, 10.8; period, 54.9 years; distance, 12.5 light years.

CASSIOPEIA. Star 42, triple, magnitudes, 7, 8.5, 9; Star 43, quadruple, magnitudes, 4.8, 10, 7.4, 8.9; period, 6 days; Star 44, variable, magnitudes, 5.3 to 12.7; variation period, 431.6 days.

Chart III

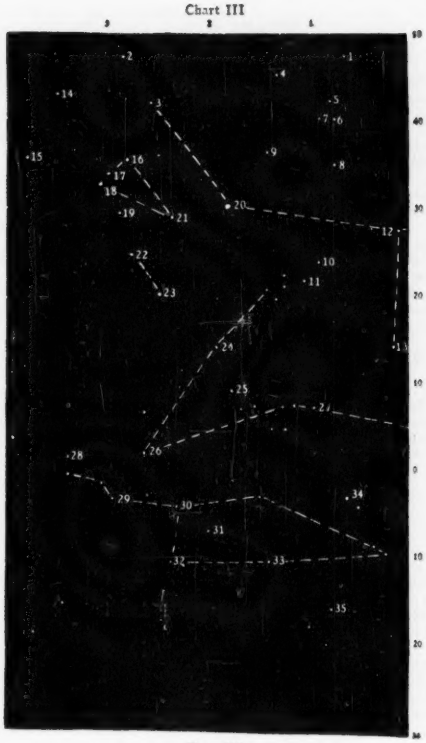


Chart IV

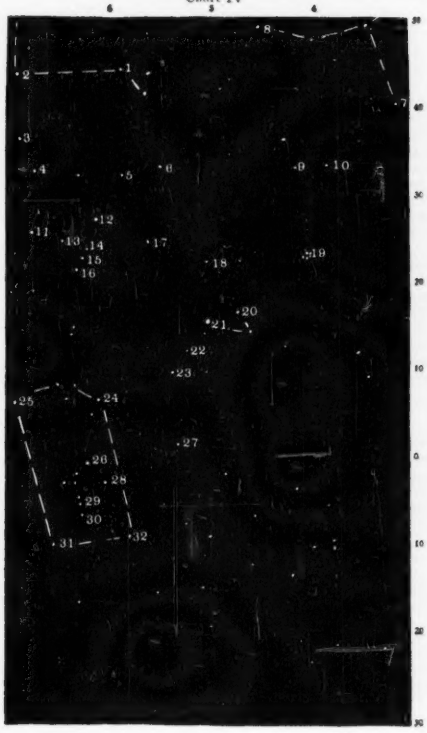


CHART III

Constellation CASSIOPEIA, Star 1, magnitude 5.02, period 1.7 days.

Stars 2 to 12 are in the constellation ANDROMEDA. Star 2, double, magnitudes, 6.4, 7.3; period, 204.7 years. Star 3, double, magnitudes, 2.3, 5.4, is a cerulean blue and gold star with a period of 55 years. Star 4, double, magnitudes, 4.9, 6.5, is made of two blazing suns. Star 5 is an oval pearl-white nebula. Star 6 is a great spiral nebula and the nearest of the spiral nebulae to the earth. It is 900,000 light years distant and 50,000 light years in diameter. On a reasonable assumption, it takes about 17,000,000 years for it to complete a single revolution and it produces one billion and a half times the light produced by our sun. It has a mass of the order of 1,000,000,000 times the mass of our sun. Star 7 has a magnitude of 4.4 and a period of 4.28 days. Star 8, double, magnitudes, 6, 9, has a period of 143.7 days; Star 9, magnitude, 2.4; Star 10, magnitude, 4.3; period, 17.76 days; Star 11, double, magnitudes, 6.1, 6.7; period, 109.07 years. Star 12, Alpheratz, has a magnitude of 2.2 and a period of 96.67 days. Its temperature is about 11,000°C.

Star 13, Algenib, in the constellation, PEGASUS, has a magnitude of 2.9. One side of the Great Square of Pegasus is limited by these last two stars.

PERSEUS, Star 14, a beautiful cluster 20,000 light years distant, Star 15, a double, magnitudes, 5.6, 6.7; period, 33.3 years.

The Constellation TRIANGULUM includes a number of interesting stars. Stars 16, 17, and 18 are almost in line and have magnitudes of 3.1, 5, and 4 respectively. Star 19, double, magnitudes, 5.6, 6.4, is sapphire-gold. Star 20 is a nebula 900,000 light years away with a period of 160,000 years. Star 21 has a magnitude of 3.5 and a period of 1.7 days.

In the constellation ARIES, Star 22, Hamal, the Shepherd's Star, magnitude of 2.2; and Star 23, magnitude, 2.7, period, 107 days.

Stars 24, 25, 26, and 27 are in PISCES.

The constellation CETUS, THE WHALE, includes at least eight interesting stars. Star 28 is a double, magnitudes, 3, 6.8. Star 29 is Mira, whose magnitude varies from 1.7 to 9.6. It has a variation period of 332 days and is 165 light years distant. It is a globe of gas 250 million miles in diameter and about 300 times the size of our sun. Star 30 is a dark nebula, and Star 31, a nebula, is unique because it is moving through space at the velocity of 1240 miles a second. Star 32 is a dark nebula. Star 33 has a magnitude of 4. Star 34 is a double, magnitudes, 5.2, 6.4; period, 6.88 years. Star 35 has a magnitude of 2.2.

CHART IV

The star Capella, Star 1, is the most conspicuous one in AURIGA. Its magnitude is .21; period, 104 days. It is 150 times as bright as the sun, has a surface temperature of 10,400°F., and is 47 light years distant. Star 2, magnitude, 2.7; period, 3.96 days; mass, 17 times that of the sun; Star 3, magnitude, 5.3; period, 28.2 days. Star 4 is a mass of 20,000 stars. Star 5, triple. Star 6 is a large sun, magnitude, 2.9.

PERSEUS, Algol, Star 7, the Ghoul, or Demon-Star; magnitude, 2.2 to 3.2; period, 2.87 days; mass, 2/3 that of the sun; 160 times as bright as the sun. Stars 8, 9, and 10, periods of 284 days, 6.9 days, and 4.4 days.

TAURUS, THE BULL, is always interesting. THE PLEIADES and the star Aldebaran are the most important. Star 11, magnitude, 4.5; period, 5.9 days; Star 12, magnitude, 1.8; Star 13, magnitude, 5; period, 27.8 days; Star 14, double, magnitudes, 5.8, 6.6; blue-white; Star 15, "crab nebula"; Star 16, magnitude, 3; period, 138 days; Star 17, a nebular cluster; Star 18, double, magnitudes, 4.3, 7.2; period, 15 days. Alcyone, Star 19, a star in the Pleiades, has a magnitude of 3 and is millions of miles in diameter. The cluster is made of over 500 giant suns and is 30 light years in diameter. The volume of each of the 5 brightest stars of the cluster is at least 800 times that of the sun. The cluster is 325 light years distant, or 2½ times more remote than THE HYADES. Star 20, magnitude, 5.6; period, 8.4 days. Aldebaran, Star 21, the "eye" of the Bull, the Hyades, magnitude, 1.1, has a diameter of 40 million miles.

ORION, THE HUNTER, Stars 22 and 23, periods, 56 years and 16.61 years; Bellatrix, Star 24, the Female Warrior, magnitude, 1.7; Betelgeuse, Star 25, magnitude, .9; period, 6 years; surface temperature, 4700°F. Star 25 is 1200 times as bright as the sun. Its volume is 27 million times and its diameter 300 times that of the sun. It is 192 light years distant and has an average density of about 1/1000 of an atmosphere. Star 26, greenish; double, magnitudes, 2, 6.8; period, 5.7 days; Star 27, magnitude, 3.8; period, 3.7 days; Star 28, double, magnitudes, 3.4, 5; period, 8 days; Star 29, a great nebula; 650 light years distant; diameter, 5 or 6 light years or 30 or 40 million million miles. It is so rare that if the air left in the supposed vacuum of an electric light globe were expanded to the size of our capitol at Washington, it would approximate the condition prevailing there. Star 30, double nebula, magnitudes, 2.8, 7.3; period, 29 days; Star 31, Saiph, magnitude, 2.2; Star 32, Rigel, magnitude, .3; distance, 543 light years; blue-white; 18,000 times as bright as our sun; temperature, 28,800°F.

CHART V

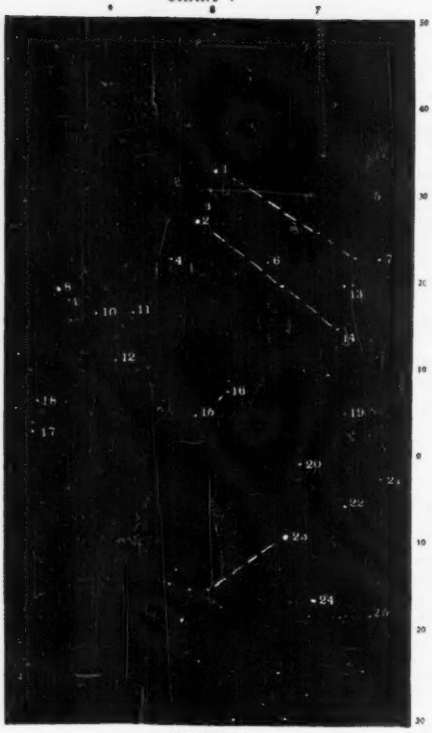


CHART VI

CHART V

The constellation GEMINI is responsible for the expression, "By Jiminy". Castor, Star 1, is an important double star, magnitudes, 2, 2.8, each part, six times as brilliant as the sun would be at an equal distance; orange-blue; 42 light years distant; period 306 years. Pollux, Star 2, the other of the "twins", magnitude, 1.2; diameter 14 million miles; 33 light years distant; Star 3, magnitude, 4.6; period, 19.6 days; Star 4, variable, magnitudes, 8 to 13; variation period, 288 days; Stars 5 and 6, barely visible; Star 7, variable, magnitudes, 3.2 to 4; variation period, 231 days.

The cluster Praesepe, Star 8, 363 suns; often referred to as a "beehive". The units vary in magnitude from 6 to 12, there being 173 in the main cluster. The cluster is about 600 light years distant. Star 9, variable, magnitudes, 8.4 to over 14; variation period, 305 days; Star 10, variable, magnitudes, 7.5 to 13; variation period, 256 days; Star 11, double, magnitudes, 5.3, 6.3; period, 60 years; Star 12, variable, magnitudes, 6 to 11.3; variation period, 362 days; Star 13, magnitude, 4.4; period, 131 days; Alhena, Star 14, the "Circlet", magnitude, 1.9; period, 2,175 days.

Procyon, Star 15, is the major star in the constellation of CANIS MINOR, or THE LITTLE DOG. It is 10.6 light years distant; 5½ times as bright as the sun; pale topaz color; surface temperature, 14,400°F. Except for Sirius, it is the closest to the earth of the larger stars. It is a double, magnitudes, 5, 13.5. Star 16, variable, magnitudes, 7.5 to 13.

Star 17 is in the constellation HYDRA and has a period of 256 days. Star 18, double, magnitudes, 3.7, 5.2; period, 15.3 years; distance, 135 light years; mass, 3½ times the sun.

The constellation MONOCEROS, THE UNICORN, includes stars 19 to 23. Star 19 is a cluster, 20 a very bright cluster, magnitude, 6. Star 21, variable, magnitudes, 7.2 to 12.9; variation period, 332 days. Star 22, double, with masses 86 and 72 times (?) that of the sun. The magnitude is 6.6, the period 14.4 days, and the distance, 10,000 light years. Star 23 is a cluster with a ruby-colored star in the center.

The constellation CANIS MAJOR, or GREAT DOG, is conspicuous because of Star 24, Sirius, the Scorcher. This star is a double, magnitudes, 1.6, 8.5; period, 49.3 years; distance, 8.9 light years; 30 times as bright as the sun; mass, 3.4 times that of the sun; surface temperature, 19,800°F., weight, on the average one ton for every cubic inch. Star 25 has a magnitude of 1.9; and a period of 6 years.

CHART VI

URSA MAJOR, the constellation of THE GREAT BEAR, extends into the area here represented and includes stars 1 to 5. Star 1, magnitude, 5.7; period, 15.98 days; Star 2, magnitude, 3.5; Star 3, magnitude, 4.8; period, 15.8 days; Star 4, magnitude, 6.6; a large, oblong nebula. Star 5 is known as the Runaway Star. Its velocity through space is such that, every two minutes, it moves a distance equal to the path of the moon about our earth. No other known star has such a velocity. In spite of this terrific speed, it apparently moves but the breadth of the moon in 300 years. This is because of its great distance from us, 21.7 light years.

The constellation, LEO MINOR, contains stars 7 and 8; Star 7, magnitude, 7.6; distance, 7.9 light years; Star 8, variable, magnitudes, 7 to 13; variation period, 370.5 days. The constellation, LEO, has as its most interesting star, Regulus. Star 9, double, magnitudes, 4.5, 8.4; period, 71.7 days; Star 10, magnitude, 3.1; Star 11, variable, magnitudes, 8.6 to 13; variation period, 273.1 days. Star 12 is Denebola, a star of 2.2 magnitude which is 25 light years distant from the earth. Star 13 is a luminous nebula and Star 14 is a spiral nebula. Star 15, double, magnitudes, 4, 7, shines with an amber-turquoise color. Star 16, magnitude, 3.8; period, 12.3 days. Regulus, Star 17, double, magnitudes, 1.3, 8.4, the chief star in the constellation, is 72.4 light years from the earth. It has a diameter of 3 million miles and is therefore about three and a half times as great in diameter as our sun. Regulus appears as a jewel in the handle of a sickle outlined by about six stars. It lies almost exactly on the ecliptic or the path made by the sun across the sky. It forms one angle of a conspicuous triangle, the other angles being at the stars Procyon and Pollux. Regulus appears conspicuously white. Star 18, also in the constellation Leo, is a variable star, magnitudes, 4.6 to 10.5; variation period, 312.8 days. Star 19, magnitude, 3.7; period, 14.49 days.

Stars 20 and 21 are in the constellation CANCER, THE CRAB. Star 20 has a magnitude of 5.1 and a period of 6.39 days; Star 21, double.

Star 22 is an oval nebula with a star center in the constellation, Leo, and Star 23 in the constellation VIRGO has a magnitude of 3.8. This area has more nebulae than any other similar area in the heavens. Star 24, in the constellation SEXTANS, double, magnitudes, 5.8, 6.1; period, 72.76 years; Star 25, in the constellation HYDRA, magnitude, 2.2; distance, 226 years. Star 26 is an elliptic, pale, steel-blue nebula.

CHART VII

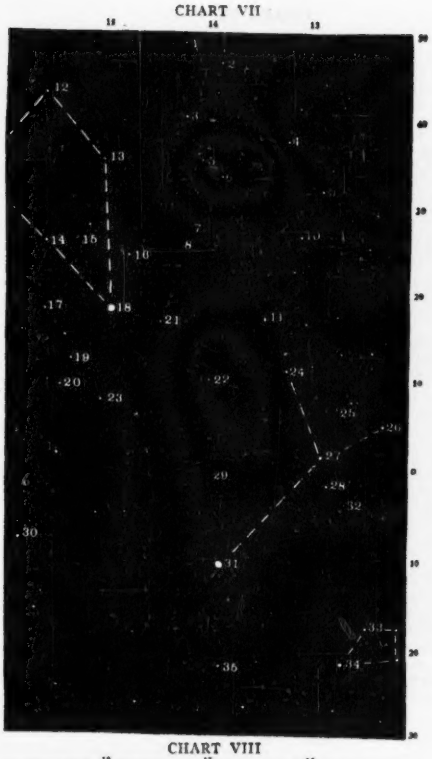


CHART VIII

CHART VII

CANES VENATICI. Star 1, Alcaid, has a magnitude of 1.9 and is 108 light years distant. Star 2, spiral nebula of enormous size, occupies a space equal to 20 million times the orbit of Neptune about the sun and, though whirling incredibly fast, it takes over 45,000,000 years to make one revolution. Star 3, variable, magnitudes, 6.1 to 12.7; variation period, 326 days; Star 4, Cor Coroli, double, magnitudes, 2.9, 5.7; period, 5.5 days; Star 5, double, magnitudes, 5, 5.8; period, 220 years; Star 6, double, magnitudes, 7.2, 7.7; period, 48 years; Star 7, a globular cluster visible with the unaided eye on a clear night; composed of several hundred thousand suns; 60,000 light years distant from the earth. This distance is so great that were our sun magnified twice and placed in the center of this cluster, it would be too small to be visible on a photographic plate. It requires light 65 years to cross its angular diameter. Star 8, double, magnitudes, 7.6, 8; period, 199 years.

COMA BERENICES. Stars 9, 10 and 11 barely visible.

BOOTES, THE HUNTER. Star 12, double, magnitudes, 7.5, 8; period, 97.93 years; Star 13, magnitude, 4.83; period, 211.95 days; Star 14, double, magnitudes, 4.8, 6.4; period, 159.54 days; Star 15, variable, magnitudes, 6.6 to 12.9; variation period, 223.3 days; Star 16, double, magnitudes, 4, 8; period, 8.6 days; Star 17, double, magnitudes, 4.8, 6.4; variation period, 159.54 years; Star 18, Arcturus, magnitude, 0.2; diameter, 21 million miles, or twenty-four and a half times that of the sun; 40 light years distant; 1/5000 as dense as water. From Arcturus to the handle of the Big Dipper is 40 degrees. Star 19, double, magnitudes, 4.4, 4.8; period, 130 years; Star 20, double, magnitudes, 7.8, 8.8; period, 238 years; Star 21, double, magnitudes, 2, 8; period, 497.1 days; Star 22, double, magnitudes, 6.3, 6.3; period, 23 years; Star 23, double, magnitudes, 5.5, 6.8.

VIRGO, THE VIRGIN. Star 24, magnitude, 3; Star 25, variable, magnitudes, 6.4 to 12.1; variation period, 145.47 days; Star 26, variable, magnitudes, 8.7 to 13.5; variation period, 339 days; Star 27, variable, magnitudes, 8 to 12; variation period, 438 days; Star 28, double, magnitudes, 3.6, 3.7; period, 182.3 years; Star 29, magnitude, 3.4; Star 30, variable, magnitudes, 4.8 to 6.2; variation period, 2.327 days. This star has an eclipse whose duration is 13 hours. Star 31, Spica, magnitude, 1.2; white; period, 4.01 days; 227 light years distant from the earth; Star 32, double, magnitudes, 8.6, 14.5; period, 218.8 days.

CORVUS, THE CROW. Stars 33 and 35, in HYDRA.

CHART VIII

BOOTES. Star 1, double, magnitudes, 5.3, 6.2; period, 204.74 years; Star 2, double, double, magnitudes, 4.4, 6.5, and 7.2, 7.8; period of last two, 244.37 years.

NORTHERN CROWN, CORONA BOREALIS. Star 3, variable, magnitudes, 7.2 to 12; variation period, 358 days; Star 4, double, magnitudes, 5.6, 6; period, 41.5 years; Star 5, Gemma, magnitude, 2.3; period, 17.36 days; distance, 62 light years; Star 6, double, magnitudes, 4, 7; period, 87.8 years; Star 7, variable, magnitudes, 7.3 to 14.2; period, 486 days.

HERCULES. Star 8, nebula; Star 9, magnitude, 3.6; Star 10, variable, magnitudes, 7.8 to 13.5; variation period, 280.2 days; Star 11, double, magnitudes, 3, 6.5; period, 34.46 years; Star 12, magnitude, 3.9; period, 4 days; Star 13, double, magnitudes, 3.5, 9.5; period, 43.23 years; Star 14, variable, magnitudes, 8 to 12.5; variation period, 221 days; Star 15, blue-green nebula; Star 16, magnitude, 2.81; period, 410 days; Star 17, double, magnitudes, 3.8, 8.2; Star 18, double, magnitudes, 3.1, 6.1; diameter, 185,800,000 miles; 21.7 light years distant; Star 19, variable, magnitudes, 8.6 to 14.8; variation period, 317.7 days.

SERPENS. Star 20, variable, magnitudes, 5.6 to 13; variation period, 357.3 days; Star 21, double, magnitudes, 3.7, 9.1; Star 22, Serpentis, magnitude, 2.8.

OPHIUCHUS. Star 23, variable, magnitudes, 7.3 to 12.6; variation period, 308.3 days; Star 24, magnitude, 2.1; distance, 60 light years; Star 25, magnitude, 2.9; Star 26, double, magnitudes, 4, 6.1; period, 134 years; Star 27, magnitude, 4.4; Star 28, double, magnitudes, 4.9, 6.2; period, 46 years; Star 29, magnitude, 4.6; period, 26.27 days; Star 30, double, magnitudes, 5.3, 6; period, 223.82 years; Star 31, variable, magnitudes, 7 to 10.5; variation period, 302.5 days; Star 32, variable, magnitudes, 3.8 to 13; variation period, 233.8 days; Star 33, magnitude, 2.9; period, 6.8 days; Star 34, double, magnitudes, 3, 8; period, .247 days; Star 35, Antares, magnitude, 1.2; 360 light years distant from the earth; diameter, about 450 times that of the sun. If the sun and its system were to occupy the same space, the earth would be buried throughout its orbit, as would also Mars. 121 million million worlds could crowd into Antares. It is a mammoth globe of incandescent gas whose density is .00001 that of water. It is said that it would take a million and one-third of earths to make one sun, 27 million suns to make one Betelgeuse and 91 million suns to make one Antares.

CHART IX

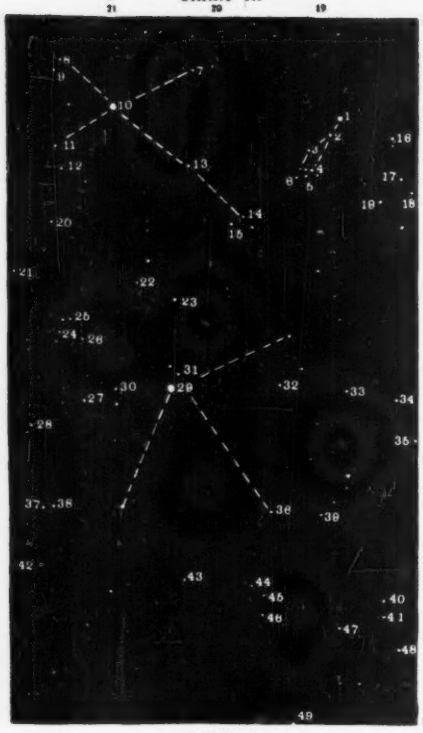


CHART X

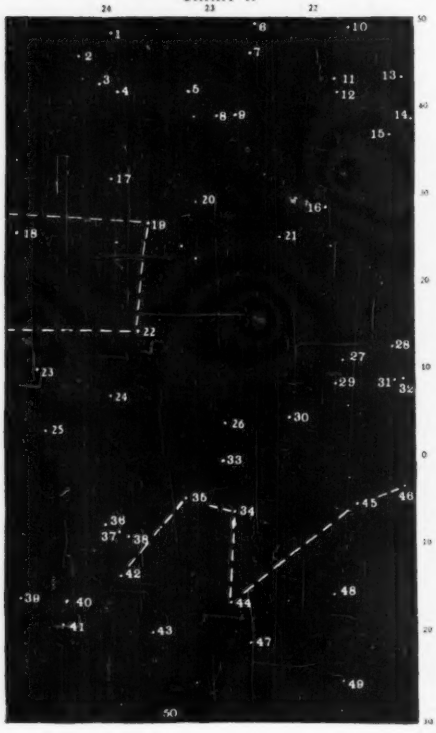


CHART IX

LYRA, THE LYRE. Star 1, Vega, magnitude, 0.1, brightest first magnitude star in northern heavens, about 50 times as bright as our sun; distinctly blue-white. 1500 Vegas would give more starlight than all the stars in our heavens; 26 light years distant, or about 8 million times as far from the earth as the earth is from the sun. Our solar system is moving towards Vega at the rate of 400 million miles a year. In about 12,000 A. D., Vega will be our polestar just as Polaris now is. Star 2, magnitude, 4.3; period, 4.3 days; Star 3, double, magnitudes, 4.5, 6.5; period, 245 days; Star 4, double, magnitudes, 3.6, 7; period, 12.9 days; Star 5, a ring nebula; Star 6, double, magnitudes, 5.2, 8.7; period, 45.8 years; Star 7, double, magnitudes, 3, 7.9.

CYGNUS, THE SWAN. Star 8, Deneb, double, magnitudes, 1.3, 12; distance, 650 light years. Though at a great distance, it is very brilliant and though it seems less brilliant than Sirius it is ten thousand times brighter than our sun. Star 9, magnitude, 4.7; period, 2.8 days; Star 10, magnitude, 2.3; distance, 540 light years; Star 11, double, magnitudes, 5, 6.3; Star 12, the eastern arm of the Northern Cross, magnitude, 2.6; Star 13, variable, magnitudes, 4 to 13.5; probably larger than Mira; variation period, 406 days; Star 14, double, magnitudes, 8.2, 8.2; period, 243.9 years; Star 15, Albireo, double, magnitudes, 3, 5.3.

HERCULES. Stars 16 to 19 not conspicuous.

VULPECULA, THE FOX. Stars 20 and 21 not conspicuous; Star 22, the Giant Dumbbell, Nebula.

SAGITTA, THE ARCHER. Star 23, double, magnitudes, 5.4, 6.4; period, 25.2 years.

DELPHINUS, THE DOLPHIN. Star 24, double, magnitudes, 4, 5; Star 25, variable, magnitudes, 8.4 to 12; variation period, 277.5 days. Star 26, double, magnitudes, 4, 5; period, 26.8 years; Star 27, nebula; Star 28, double, magnitudes, 5.8, 6.3; period, 97.4 years.

AQUILA, THE EAGLE. Star 29, Altair, blue-white, magnitude, 0.9, or nine times as bright as our sun; 15.4 light years distant; Star 30, variable, magnitudes, 7.6 to 13; variation period, 284.4 days. Star 31, distance, 112 light years; magnitude, 2.8; Star 32, variable, magnitudes, 5.8 to 12; variation period, 355 days; Star 33, variable, magnitudes, 6.5 to 9; variation period, 335 days; Star 34, nebula; Star 35, double, magnitudes, 4.1, 6; period, 87.8 years; Star 36, not visible to naked eye.

AQUARIUS. Stars 37 and 38; SCUTUM. Stars 39, 40 and 41; CAPRICORNUS. Star 42; SAGITTARIUS. Stars 43 to 49.

CHART X

The area here covered is relatively poorly supplied with important stars.

In the constellation, ANDROMEDA, we have Star 1, a rose-colored star, magnitude, 5; Star 2, magnitude, 4; period, 20.54 days; Star 3, a bright blue-green, elliptic nebula; Star 4, magnitude, 5.9; period, 3.22 days.

The constellation, LACERTA, THE LIZARD, shows Star 5, variable, magnitudes, 8.3 to 14.5; variation period, 298.7 days; Star 6, a cluster; Star 7, magnitude, 4.6; period, 2.6 days; Star 8, a double double with magnitudes of 6.5, 6.5 and 8.5, 10; Star 9, magnitudes, 8 to 12.5.

The constellation, CYGNUS, shows us Star 10, a cluster; Star 11, a variable; magnitudes, 8.4 to 12; variation period, 103.6 days; Star 12, a triple, magnitudes, 7, 7.9, 11; Star 13, a nebula; Star 14, double, magnitudes, 5.3, 5.9; brightness, .064 as bright as the sun; Star 15, double, magnitudes, 3.8, 8; period, 47 years; Star 16, double, red-gold to purple, magnitudes, 4, 5.

PEGASUS is represented by Star 17, a double, magnitudes, 5.5, 7.5; Star 18 double, magnitudes, 5.8, 11; period, 26.4 years; Star 19, Scheat, whose diameter, 150 million miles, would enclose 5,000,000 suns; distance 541 light years; magnitude, 2.2; Star 20, magnitude, 3.1; period, 818 days; Star 21, magnitude, 3.6; period, 10.21 days; Star 22, Markab, magnitude, 2.6; distance, 272 light years; Star 23, double, magnitudes, 6.9, 7.3; Star 24, variable, magnitudes, 7.8 to 13; variation period, 317.5 days; Star 25, a glowing ember, magnitude, 6.2; Star 26, a double, magnitudes, 5.8, 7.2; Star 27, a globular cluster; Star 28, a variable, magnitudes, 8 to 12; variation period, 262 days; Star 29, a triple, contrasting colors; magnitudes, 2.5, 8.8, 11.5; Star 30, variable, magnitudes, 8.2 to 14; variation period, 303 days; Star 31, double, magnitudes, 5.3, 5.4; period, 5.7 years; Star 32, a triple, magnitudes, 4.1, 5.7, 11; Star 33, double, magnitudes, 4, 4.1; Star 34, double, magnitudes, 5.6, 5.7; Star 35, triple, magnitudes, 7, 7.5, 8; Star 36, double, magnitudes, 7, 8; Star 37, double, magnitudes, 7, 8; Star 38, double, magnitudes, 4, 8.5; Stars 39 to 47 either invisible to the naked eye or nearly so, and relatively unimportant.

CAPRICORNUS, Star 48, magnitude, 3; Star 49, magnitude, 5.

Fomalhaut, Star 50, magnitude, 1.3 and distance, 25.51 light years, is seen in autumn in the constellation, PISCES AUSTRALIS, or SOUTHERN FISH.

How to Make a Planisphere

A PLANISPHERE for finding the common northern constellations may be made by cutting out, or tracing, the sections on the right.

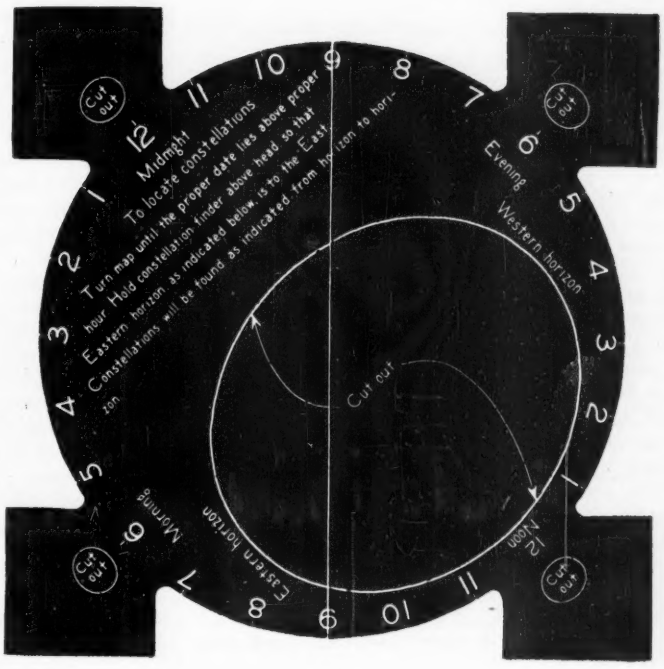
Mount the circular map on a stiff piece of cardboard and cut it out in a circular form.

Mount the frame similarly and cut out the areas indicated to be removed.

Select a third card, the size of the frame, and lay it on a table. On each of the corners lay one or two thicknesses of card such as was used to mount the map. Place the map in the center of this third card and fasten the corner pieces with glue so that the map has only slight opportunity to get out of position. Place the frame over the map and the other cards. Fasten the frame to these cards with tape or *passe-partout* so that the map may be moved about inside the frame and the third card enclosure.

To locate a major constellation follow the directions on the front of the frame. Do not expect to find all of the constellations at any one time of the year.

NOTE: If it is desired that the printed planisphere be cut out do not remove this column since the general directory of stars and constellations is printed on its back. This should remain with the text for convenience. A copy may be made of the list of references on the reverse of the planisphere plan.


Midnight
To locate constellations
Turn map until the proper date lies above proper hour Hold constellation finder above head so that Eastern horizon as indicated below is to the East Constellations will be found as indicated from horizon to horizon
Cut out
Evening
Western horizon
Cut out
Eastern horizon
Morning
Cut out
Noon
Cut out

This special educational insert — as well as all of the others in this series — is so placed in the magazine that it may be detached and preserved in a note-book cover. This insert, in particular, will be found useful in connection with Nature Magazine's regular astronomy article by Isabel M. Lewis, a feature long popular with the sky-minded readers of the magazine.

ACKNOWLEDGMENT

THIS outline for the study of the stars is modified from a similar article prepared by the author and published in a more comprehensive form as *Cornell Rural School Leaflet*, Volume 23, Number 3, in January, 1930. The revision is made with the permission of the New York State College of Agriculture, publishers of the initial article.

As has been the case in the preparation of similar articles on other subjects, the author has supplemented his own experiences with those of others, and has, of course, received help from books. In the preparation of this material particular credit is due to Professor S. L. Boothroyd of the College of Civil Engineering of Cornell University, who reviewed the manuscript and made many helpful suggestions. The books found most useful in the preparation of this material and to which acknowledgment is due are as follows:

Introducing Constellations, by Robert H. Baker, The Viking Press, New York City, 1937.

When the Stars Come Out, by Robert H. Baker, The Viking Press, New York City, 1934.

The Universe Unfolding, by Robert H. Baker, Williams and Wilkins Company, Baltimore, Md., 1932.

1001 Celestial Wonders as Observed with Home-built Instruments, by Charles Edward Barns, Pacific Science Press, Morgan Hill, California, 1928.

Handbook of the Heavens, edited by Hubert J. Bernhard, Dorothy A. Bennett and Hugh S. Rice, Whittlesey House, McGraw-Hill Book Company, New York City, 1935.

Our Wonderful Universe, by Clarence A. Chant, World Book Company, Yonkers-on-Hudson, New York, 1929.

Through the Telescope, by Edward Arthur Fath, Whittlesey House, McGraw-Hill Book Company, New York City, 1936.

Exploring the Heavens, by George Clyde Fisher, Thomas Y. Crowell Company, New York City, 1937.

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Worlds Without End, by H. Spencer Jones, The Macmillan Company, New York City, 1935.

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A Beginner's Star-book, by Kelvin McKready, G. P. Putnam's Sons, New York City, 1937.

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Field Book of the Skies, by William T. Olcott and Edmund W. Putnam, G. P. Putnam's Sons, New York City, 1934.

Stars and Telescopes, by James Stokley, Harper and Brothers, New York City, 1936.

THE SKY AT NIGHT

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The I. U. P. N. at Caracas

★

With the sessions of the Third General Assembly of the International Union for the Protection of Nature in Caracas, Venezuela, in early September, that international group definitely came of age. It has, in fact, made remarkable strides since it was created four years ago in Fontainebleau, France, to provide a world agency for governments, international organizations, and organizations within nations, concerned with conservation of natural resources and protection of species and areas.

Perfecting an international organization is no mean task in itself, but when such a body can attract the support of six governments — Venezuela joined the list during the Caracas meeting — four international organizations, and 162 organizations in twenty-six different countries in four short years, it is a tribute to the zeal and vision of conservationists of many lands.

At Caracas it was possible to broaden the base of the discussions of the Assembly. The first two General Assemblies had been faced with problems of perfecting organization and developing a program. Both of these goals have now been accomplished, and the meeting in Venezuela was able to focus attention on various world problems.

One issue that conservationists in the United States, for example, have been inclined to regard as peculiar to this country is the effect of hydroelectric and other dam building activities on other natural resources. The recent sessions revealed that this is a widespread issue and it was thoroughly aired from all points of view, and the subject of affirmative action by the Assembly. Resolutions were unanimously adopted reminding governments of the inviolability of such areas as national parks, and urging thorough consideration, by competent specialists, of all natural resource values affected by dam developments.

One of the major concerns of the Union is the preservation of wildlife species, and one session was devoted to the problem of conserving wildlife in semi-arid regions, with particular reference to Central and South American species. Resolutions were adopted urging establishment of reserves, national parks and refuges that would protect species and serve to restock surrounding territory. Other resolutions recommended measures that would reduce human pressure on these reduced wildlife resources, including such regulation of hunting as would avert extermination or alarming diminution of local fauna.

Another subject actively discussed was the effect of fire and the practice of regular burning. Opinions differed widely as to both the immediate and long range effects of this practice, but the general conclusion was that it is basically damaging to the soil. Resolutions urged educational programs looking to the elimination of burning as an agricultural practice, and the incorporation in the conservation laws of various countries fundamental regulations with respect to this problem. A permanent commission of the Union was proposed to coordinate and disseminate the results of research on this subject, and it was recommended that it be included in the agenda for the next technical session of the Union, which will be held in Salzburg, Austria, in 1953.

On the list of endangered species of birds and mammals are many indigenous to island habitats, including many in the Caribbean Sea. On such islands population pressures have been particularly severe. Resolutions of the Assembly urged the creation of reserves for such threatened species, the limitation of hunting and the stimulation of local and regional organizations in the Caribbean area that would undertake programs of survey, research and protection of natural communities of both animals and plants.

Since the General Assembly was being held in Latin America, particular emphasis was placed upon conservation problems there. One resolution adopted congratulated the Pan American Union for its interest in and activity with respect to conservation education, and expressed the hope that it will establish a comprehensive education program throughout Latin America.

Among the plans approved by the Assembly, on recommendation of the program committee, were preparation of a handbook on the fundamentals of Nature protection, maintenance of a conservation service, publication of an atlas of Nature reserves of the world, organization of conservation camps, dissemination of additional educational material of various kinds.

Of course, beyond the deliberations of the sessions of the General Assembly, valuable as they were, was the personal interchange of ideas and information between the delegates and observers from so many countries. This is usually an important by-product of any conservation gathering, and when the meeting is on an international scale the benefits derived seem even greater. Save for Venezuelans, the delegation from the United States was the largest in attendance, indicating the world viewpoint held by our conservationists.

Certainly the record to date proves the possibilities that lie before the International Union for the Protection of Nature. What it has been able to do on a too slender budget, and the influence it is already able to wield, demonstrate that the Union is worthy of widespread support in its world approach to conservation of natural resources.

PHOTOGRAPH BY THE AUTHOR

PHOTOGRAPH BY W. R. MATTOON, U. S. FOREST SERVICE

The cut at the left is nearly nine feet deep and the trees in the background are mostly Virginia pines, oaks and tulip-poplars. The many large holes in this cross-section of a forest soil are a product of decayed roots and the burrowing of small soil animals. Such holes permit large quantities of water to pass downward in a short time. The excess water drains slowly off into springs and streams.

Deep Go the Roots

By BERNARD FRANK

HOW DEEP do roots go? How does their depth affect the movement of water, both upwards and downwards, through the soil? And what has this to do with floods? Not long ago I had an excellent opportunity to satisfy my curiosity on the first question, and to gather some additional information that will help answer the other questions.

This opportunity to learn more about the rooting habits of trees and other plants came to me when building excavations started next to my home near Rock Creek, in Montgomery County, Maryland.

Rock Creek is a small watercourse of the Piedmont region. It rises about ten miles north of Rockville, the county seat of Montgomery County, and flows southwesterly into the District of Columbia, and through the heart of the Nation's Capital, joining the Potomac River in the Old Georgetown section of Washington, D.C. Its long, narrow watershed, some seventy square miles in area, is largely in farms and small communities, except for the densely populated District of Columbia and its Maryland suburbs. The soils are largely loams (made up of about half silt particles and small proportions of clay and sand), and are reported to be two to four feet deep, except on the narrower ridge tops and steep slopes. The land is mostly rolling to hilly, with fairly gentle slopes except along the main creek, where slopes are steep and often rocky, as in Rock Creek Park in the District of Columbia, and in adjacent Maryland.

Rain comes every month in the year. Although more rain falls in July and August than in any other month, drenching downpours are apt to come during fall, winter or spring. Altogether, about forty-two inches of rain (and sometimes snow) falls on the watershed during the average year. However only a third of this amount enters Rock Creek as streamflow; the rest is evaporated, or transpired back to the air by plants, or else sinks into deep rock crevices far below the surface.

Originally the watershed contained hardwood forests of oak, beech, hickory, tulip-poplar and many other kinds of trees. Over the years, however, land clearing for such purposes as grain and dairy farming, residential construction and streets, have greatly altered the landscape. Along with these changes have come many changes in the character of Rock Creek itself. Formerly a stable, clear-flowing stream, the now usually turbid creek rises swiftly after each hard rain or thaw. Overbank floods come often and at various times throughout the year, as in November, 1942, February, 1948 (following a thaw after a long period of freezing weather), August, 1948, and June, 1951.

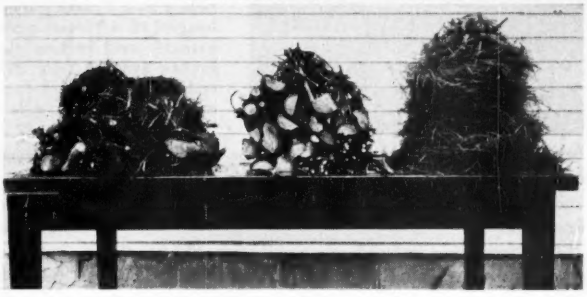
My observations on the depth of the soil and roots exposed by the excavations helped me to understand

The northern red oak at the left grew in Maryland and developed a dense, spreading root system. Its roots could not penetrate the hard granite rock below.

PHOTOGRAPH BY C. G. BATES, U. S. FOREST SERVICE

The three piles below represent the results of cutting up a small loblolly pine (in the South Carolina Piedmont) into roots, stem and bark, and needles. The roots shown in the left-hand pile represent 30 percent of the total oven-dry weight of the tree; stem and bark, 55 percent, and needles, 15 percent. The total length of the roots and rootlets was 4300 feet.

PHOTOGRAPH BY MARVIN D. HOOVER, U. S. FOREST SERVICE



better the reasons for some of the changes in the behavior of Rock Creek during the ten years I have lived in its vicinity.

The dense woods in my neighborhood are like many other areas one can still find in the suburbs of Washington. Some are grown-up old fields, once in corn or wheat, and here the Virginia pine, or tulip-poplar (depending on the soil and location) comprise the main trees. Other areas were cleared and abandoned long ago — or else never cleared at all — and here many kinds of hardwood trees and undergrowth occupy the land. Some of the trees are fine specimens well over 150 years old and more than three feet thick, as along the slopes of Rock Creek near the community of Forest Glen. Because these bits of forest are rarely cut or grazed, seldom burned over, and used lightly only by playing children, hikers or horseback riders, the mineral soil beneath is well protected by a highly porous mat of decaying leaves and twigs. Innumerable insects, worms, and other animals cultivate the humus-rich topsoil and keep it well aerated so that it readily takes in rain or fast-melting snow. This I have often observed during summer storms and winter thaws.

Within a foot of the surface one finds a maze of roots growing every-which-way to obtain nutrient-rich moisture, or else to avoid rocks in their path. I was especially impressed with this concentration of roots near the surface when I dug a couple of compost pits about 3 feet deep into the yellowish clay loam subsoil. I noticed, however, that quite a few sizeable roots (some three inches thick) extended the full depth of the pits. These roots belonged to nearby white oak, northern red oak, Virginia pine, and dogwood trees.

How much deeper did the roots go, anyway? The excavations of the Diesel-powered shovel provided a much better answer than my spade could. Carefully scraping the faces of several cuts about nine feet deep, I found live and dead roots easily visible to the naked eye, not only in the yellowish subsoil, but also in the compact reddish clay layer below that, and even in the soft, sandy rotten rock (called "mica schist" by geologists) clear down to the bottoms of the cuts. These roots came from tulip-poplar, white oak, and Virginia pine trees. My count of the annual rings on the fresh stumps of the large trees nearest the cuts showed them to vary from 85 years old (pine) to 110 years old (white oak).

What can such deep "soils" and roots have to do with floods? When it rains, part of the water enters the surface pores of the soil and moves downward. How much water will move downward, and how fast, depends on the size and arrangement of the pores, or air spaces, in each layer of soil. Large and small pores together make up about half the total volume — a cubic foot of most any soil will contain about half a cubic foot of air.

As the moisture moves downward it first fills the tiny pores (whose diameter is generally less than two thousandths of an inch) of the upper soil layers. Here the particles of water cling so tightly to the tiny particles of soil around the pores that not even the pull of gravity can tear them loose. Only the powerful forces of evaporation and plant transpiration can move them. None of this water reaches the springs or streams. Sooner or later it all goes back into the atmosphere.

Each foot-deep layer of a clay soil can store as much as three and one-half inches of water in the small pores

The paper strips show where roots emerge to the face of the cut. The humus and yellow colored clay loam layer beneath are 1.8 feet thick; the reddish colored clay layer is another 4.6 feet thick; and the sandy rotten rock of the lowest layer (shown below upper paper) is 2.3 feet thick. The lowest root shown is 8.7 feet below the surface.

The lowest strip of paper is next to a root which comes out of the rotten rock 8.9 feet below Bob Frank's feet. It belonged to a Virginia pine. The humus and yellow clay loam layers are 1.3 feet thick, the reddish clay is 1.1 feet thick, and the rock layer is 4.5 feet thick.

between its many fine particles. On the other hand, a coarse sand, comprised mainly of large soil particles and large pores, may store as little as one-half inch per foot of depth.

The large pores do not begin to fill up until after the small pores have all the water they can hold. These large pores, greater than two thousandths of an inch in diameter, represent the spaces between the larger particles of soil. Other large spaces — channels of various kinds — are created by the burrowing or tunneling of animals, and by the growth, movement, and decay of roots.

The greater the proportion of large pores, the faster water will pass downward from one soil layer to the next. Water will move faster through coarse sand, and most any well protected forest soil for that matter, than through heavy clay soil, especially one that is only sparsely covered by plants, as on a heavily grazed pasture or a corn field.

After the small pores are filled, practically all the water that enters the large pores moves out of the soil. This water keeps the springs, brooks, and streams flowing during dry periods. In shallow or coarse soils — gravelly sand, for instance,— this water may drain out so fast as to contribute directly to overbank floods. But where soils are deep and fine-grained, the water may not appear in springs, wells, or stream channels for days, weeks, or even months after it first enters their large pores.

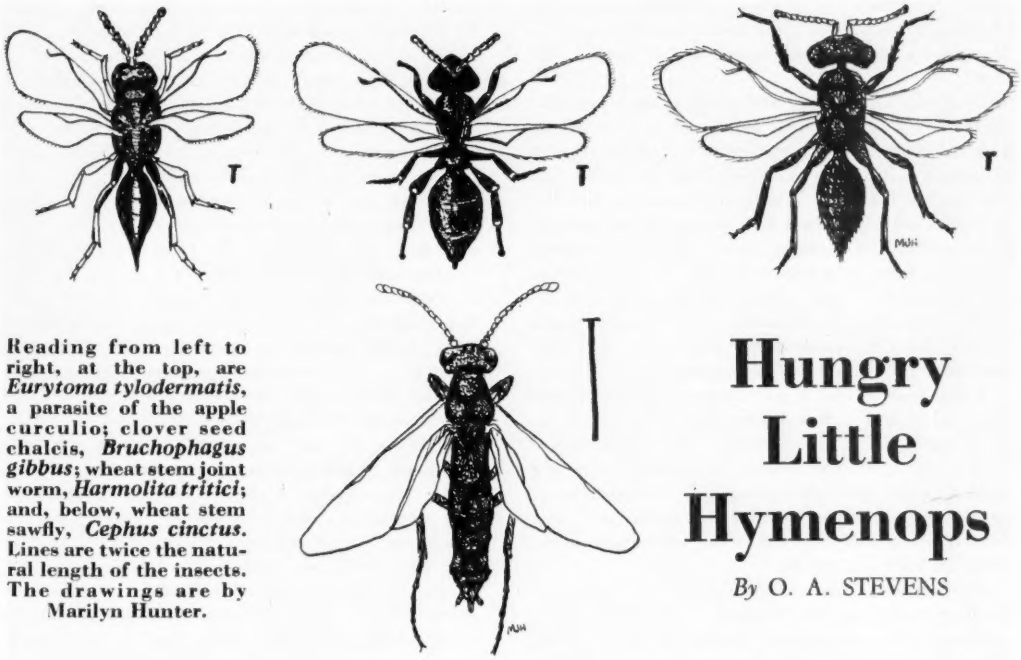
Wherever we find a dense plant cover we will also find many large and small channels down to the tips of the finest roots. Taproots and wide-spreading lateral roots are especially effective in helping water move through tighter soils that otherwise would be unable to absorb heavy rains fast enough to avoid the danger of water running over the surface, a major cause of flash floods.

Roots serve another important purpose besides helping speed up the movement of water in the soil. During the growing season the hundreds of feet of roots also absorb large amounts to be carried upwards into the stems and leaves of the plants. The water is pulled upward by the pressure exerted by the leaves. This pressure will vary from as little as five pounds per square inch — as when the soil is very moist — to as much as 225 pounds per square inch — as when the soil is very dry. These pressures result from the effects of sunshine, wind, and dry air on the leaves.

How much water the leaves can draw up depends on the amount that is stored in the small pores of the soil within reach of roots. Thus, plants whose roots extend down only two feet can draw water only half as far as plants with four-foot roots.

Since deep-rooters dry out the soil to a greater depth than shallow-rooters, the lower layers of the soils they occupy have more room to take in water when rains come. In other words, quick floods are much less likely to result from a heavy summer rain where roots go deep than where only shallow-rooters grow. Of course, the deep-rooters, by using more moisture, reduce the amount that would otherwise drain off into springs and streams. But the water that gets into the streams is clearer and safer to drink for having first filtered through the soil. Also, deep-rooted plants are highly effective in holding the soil on steeply sloping lands.

Let us take an example of how roots help reduce floods. Many of the tree roots shown in two of the illustrations go down at least nine feet. Each foot of this kind of "soil" can hold around three inches of water in its small pores. (Continued on page 498)



Reading from left to right, at the top, are *Eurytoma tylodermatis*, a parasite of the apple curculio; clover seed chalcis, *Bruchophagus gibbus*; wheat stem joint worm, *Harmolita tritici*; and, below, wheat stem sawfly, *Cephus cinctus*. Lines are twice the natural length of the insects. The drawings are by Marilyn Hunter.

Hungry Little Hymenops

By O. A. STEVENS

THE world is encumbered with insects. They swarm through the air, over the ground, through the ground and through the waters. They invade our fields and gardens, our granaries and clothes closets. The number of kinds is legion and the numbers of individuals incalculable. The damage done annually by any one of several species runs to millions of dollars. Other species do not annoy man; some are highly beneficial. Not all kinds are numerous. Rare specimens of some command high prices, after the manner of postage stamps and paintings.

Obviously, insects are important. A knowledge of the injurious and beneficial kinds is essential to man, but a study of the many others is interesting and usually contributes something worth while in a practical way. Much has been written but it must be evident that many, many kinds have interesting stories yet untold.

The scientist divides insects into several large groups called "orders." Some of these are easily recognized and labeled by a simple word or two. Many of his names refer to the wings. Thus Diptera are two-winged — flies; Coleoptera — beetles — have hardened shields for their fore pair of wings; Lepidoptera have wings covered with scales — butterflies and moths.

Hymenoptera have been more difficult to characterize so briefly. Literally the name — hymen and pteron — means "joined wings," referring to the row of little hooks on the front edge of the hind wing which attaches it to the forewing. This tells us little about the insects. We say the group includes bees, wasps, and ants, but to these we must add a more motley crowd, saw-flies, ichneumons and gall-insects at least. Gall-insect is indefinite because many kinds of tiny flies, plant lice and others produce plant galls. But it is to some of the tiny members of this section that I wish to call attention.

Last year, in some of the sparsely inhabited part of western North Dakota, I collected the pods from a single plant of two-grooved milkvetch, *Astragalus bisulcatus*. I merely wanted to know how many seeds it produced. The plant is interesting. It is a large, bushy plant and produces a mass of reddish-purple flowers, which make it one of the showy species of that region. In recent years it has attracted unfavorable attention because it has a habit of extracting selenium from the soil. This makes the plant poisonous to livestock, and it even poisons the soil with its decaying remains so that grains and vegetables become poisonous.

When we came to thresh the seeds, fully half of them had been ruined by insects. I took the damaged seeds to the entomologist. "Clover seed chalcis" was his verdict. Now I have had a nodding acquaintance with clover seed chalcis for nearly fifty years. I had seen red clover and alfalfa seeds with a hole in each, sometimes with the dead insect inside. I had seen the insect referred to as one of the pests of clover seed, but what was it doing in a native legume far off the beaten path?

Fortunately we had, within months, for the first time, a comprehensive directory to Hymenoptera. So I took down the thick volume to learn more about this creature. The verdict was brief. "Cosmopolitan," or

found everywhere. It gave some references and names of plants that the insect had been reported to attack. My plant was not among them: in fact the list was short.

I had added little to my knowledge of the clover seed chalcis but I became much interested in its relatives. I should not have been surprised to find that each kind of legume seed had its own special kind of chalcis, but this was not the case. Seventy years ago, the late Dr. L. O. Howard, chief of the U.S. Bureau of Entomology, had described this insect as a new species. He believed it to be a parasite of a fly larva that fed on the seeds, and commented that it was much like a species described from Sweden forty-five years earlier. Later workers have pronounced the two to be the same species, so it has been known for more than a century.

A few years later, A. D. Hopkins discovered that this chalcid was a true vegetarian. The female deposits her eggs in the young clover seeds and the larvae devour the substance of the seed. About three and one-half weeks after the eggs are laid, the adult insect escapes through a tiny circular hole in the seed coat. Individuals that develop late in the year remain in the seeds until the next season.

Dr. Hopkins' discovery did not clear the history of the long name of the tiny creature, for W. H. Ashmead had described a species from Ontario and another from New Mexico, giving them the generic name *Bruchophagus*. Bruchids, it should be explained, are beetle weevils of legume seeds, the common bean weevil and many others. A recent worker added a third species from Arizona, habits unknown. So the record stands, these three consorting with the old and well known vegetarian, the clover-seed chalcis.

Working back down the family group, the next is an isolated member described by Ashmead from Florida. Apparently no one has added to its history, although it had known relatives in Europe many years before. Then the picture changes. We have *Eudecatoma*, with forty species and a few varieties, and, next to it, *Eurytoma*, with no less than sixty-nine species. These seem to prey upon bruchids and gall insects of different kinds. Some have been known only to the original describer, others have a long history and have been reported from as many as forty hosts.

The list goes on through some more relatives, one living on a bee, another on a tree-cricket and so on to *Harmolita*. Here I feel more at home. *Harmolita* has sixty-five species, almost one for each host and the describers nearly ran short of names. These are vegetarians, not parasites of parasites. *Harmolita tritici*, the book admits, is "commonly known as the wheat jointworm." The other species affect various grasses.

The wheat jointworm is a major pest. We are told that it attacks only wheat, and that the loss caused is second only to that from Hessian fly. The eggs are deposited inside the wheat stem near the joints. They hatch in about two weeks, the larva grows while the plant should be making its best growth, but the stem is weakened and the development of the seeds arrested. As the plant matures the larva goes into the pupal stage and remains in the straw until spring.

A wayward cousin of the jointworm is *Eurytoma parva*. The female, with radar-like senses, locates a jointworm in the stem and deposits her egg by it. The *Eurytoma* larva attacks and destroys the jointworm, and continues feeding upon the wheat stem.

It is odd that the jointworm should confine itself to wheat, but it has numerous brothers who feed upon other grasses. In 1936 Dr. W. J. Phillips published a revision of the genus *Harmolita*. Ten species had been described since 1919, and he described twenty more. Nine of these were collected by my late good friend C. N. Ainslie, mostly in North Dakota. Three different ones were reared from green stipa grass, *Stipa viridula*, others from wheatgrass, wild-rye, orchard grass, bentgrass, bromegrass and bluegrass.

All these are but one small family of the little hymenops. Pages upon pages — more than six hundred — are occupied with the mere listing of others, some vegetarian, some carnivorous. Away, away up at the front, in an entirely different corner is another pest, the wheatstem sawfly. The sawflies are vegetarians. The larger ones boldly chew leaves like caterpillars and the young of beetles, but the wheatstem sawfly bores from within. The adult is very different from the *Harmolita*, but it is still a small, black, flying insect. The egg is deposited in the wheat stem near the ground. The larva gnaws the inside of the stem and it becomes weakened and falls over. It should be mentioned that the blighted heads often seen in wheat and other grasses soon after heading are caused by the stem maggot, a fly larva that works inside the stem just above the topmost joint.

The distribution of these tiny insects seems mysterious. The entomologists tell me that the wheat jointworm is unknown in North Dakota, but we have its many relatives on wild grasses. The wheatstem sawfly has reached us and caused much concern. If the clover seed chalcis came from Europe it spread very rapidly before it was noticed. By 1920 it was present in all the alfalfa seed producing areas.

Not all of these hymenops are small but the tiny ones seem to preponderate. There are many ichneumons of fair size. They come in all colors and often resemble common species of wasps. They are usually slender bodied and have long slender antennae but are not swift of flight. Frequently in passing a tree we may see fine sawdust oozing from a hole in the trunk. This may be the work of the horn-tail. The adult is a stout, red and black, wasp-like insect with a short, stout boring apparatus at the end of the abdomen. Standing over one of these burrows we may find the queen of ichneumons, a slender, purplish-black insect more than two inches long. Her boring apparatus is slender but longer than her body. In action she loops it over and forward, its tip feeling out the trunk and depositing an egg where the infant ichneumon can attach to the horntail larva.

Singing Mountain

By NELL MURBARGER

Photograph by the Author

VIEWED from U.S. Highway 50, between Salt Lake City and Reno, Nevada's strange Singing Mountain bears the general appearance of any large desert dune. By following a winding side road for three miles to the foot of the mountain, however, the unusualness of this great sand-pile becomes immediately apparent.

With its wind-sculptured crest lifting nearly 1000 feet above the floor of the desert, it is believed to be the tallest sand dune in the United States. And, since the dune's total length is little more than a mile and its width much less, its precipitous approach and loose footing make it unscalable by any but the very robust.

In addition to its amazing height, Singing Mountain has the added peculiarity of a built-in "sound track" — a desert phenomenon also reported from a few other widely separated dune areas in Africa and China. While "music" emanating from Nevada's sand mountain is generally likened to the strains of a massed chorus in the far distance, the effect, at other times, is said more closely to resemble the playing of ghostly violins, or the thin piping of many flutes.

Even prehistoric Indians of the region had deep-seated regard for this desert oddity. Coupled with the fact that the dune was constantly changing in form as fingers of the wind played over it, the mysterious undertone issuing from the sand caused superstitious redmen to believe that the dune was the abiding place of a powerful spirit whose possible wrath they sought to appease through pagan ceremonials and obeisance.

Two theories have been advanced as possible explanation of the phenomenon. According to one belief, the strange "singing" is the audible result of billions of minute sand crystals being tumbled and rolled, one against another, by the restless wind. As the "singing" appears to be more pronounced in the hours immediately

after sundown, the second theory is based on the idea that the great mass of silica sand absorbs the sun's heat throughout the day. With nightfall, as each sand particle begins to cool and contract, the dune automatically shifts and settles, and in such movement the strange sounds are believed to have their origin.

Aside from its scenic and geologic interest, man has found little use for the giant sand pile. An occasional recreation seeker employs its precipitous sides for summer "skiing" — an unusual sport said to rival snow skiing in thrills. As skis built for use on snowfields are soon worn through by abrasive contact with the sand, special metal skis must be used.

Numerous attempts have been made to market the sand for railroad and flue purposes; all such efforts having been thwarted by high cost of transportation. Nor has it been found feasible to use the sand for glass making. While the dune shows a high content of silica, analysis also reveals soda feldspar, two percent iron, a small amount of calcium carbonate, and fifty cents worth of gold to each ton. Using high intensity magnetic separation, approximately one-half of the iron content may be removed but the remaining one percent — locked in the crystal lattice of the feldspar — has not been found removable by any known method. Use of the sand for purpose of glass making is thereby precluded, since any considerable content of iron has a tendency to discolor the finished product.

Barring development of some new method whereby the noxious iron content may be removed, or possible discovery in the sand of some strategic new element, it seems likely that Nevada's great Singing Mountain will remain unexploited, its only visitors an infrequent tourist or thrill-seeking recreationist.

The dune is situated approximately twenty-eight miles east of Fallon, in Churchill County.

Bats

By
ELINOR HENRY BROWN

A man who has made pets of bats
Says that bats are better than cats
  Or canaries or guppies
  Or chinchillas or puppies —
In fact, he is bats about bats!

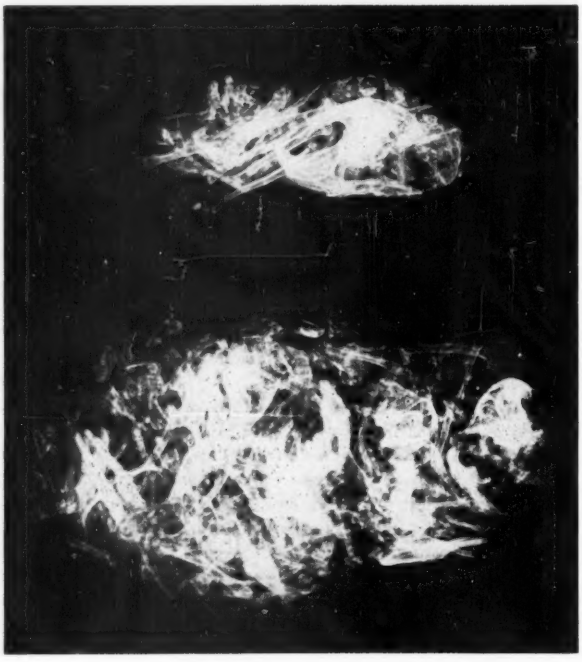
Owl Pellets X-Rayed

By PERCY GHENT

Radiograph by the Author

EXAMINATION of the pellets of such birds as owls and hawks reveals the beneficial service rendered by a group of birds against which the hand of man has long been raised. The radiograph here shows the small pellet of a short-eared owl and the larger pellet of the snowy owl. It reveals the skull, jaw, long bones and scattered bits of spinal columns of rodents injurious to the farmer.

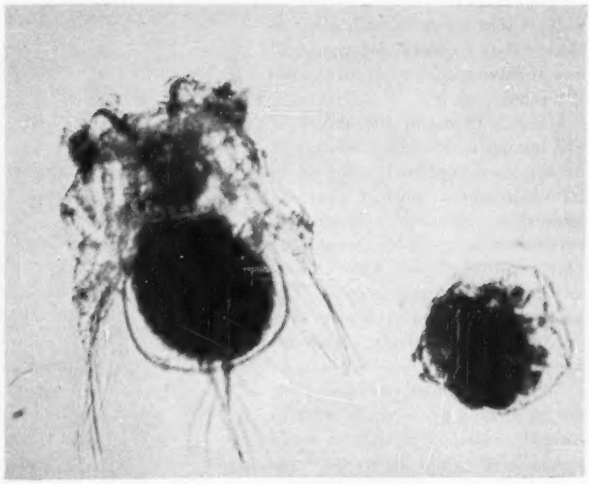
During a recent visitation of snowy owls to southern Ontario, 511 pellets of these birds were carefully studied at the Royal Ontario Museum in Toronto. From the bones 2053 food items were identified. Of these 1739 were of meadow mice, 226 other species of mice, 45 house rats, three rabbits. Birds, ranging from old squaw ducks to starlings and pigeons, made up the balance. In all, there were 2021 mammals — almost exclusively harmful rodents — and thirty-two birds identified from the skeletal remains. This puts the snowy owl high on the list of predators whose diet is helpful to man.



Nature's Tiniest Turbines

By JOHN TAYLOR

Illustrations by the Author



At the left is a species of *Pedalia* with long swimming appendages attached around the top. The extension of the corona and other parts of the head above these appendages give the animal the appearance of a clown's face. On the right is *Brachionus angularis*, a very small rotifer that lives in a shell or lorica. The head projects from the opening at the right, and the foot through the aperture at the left.

AMONG the fascinating and versatile organisms found near your doorstep, the tiny rotifer, alias the wheel animalcule, is probably the most bizarre and perplexing. It is likely that you have never seen a rotifer unless you have examined a drop of water from an open source under a microscope. Roadside ditches and ponds teem with them; funeral urns and moss leaves harbor immense numbers of them; and even your fishpond and garden furrows are populated with these tiny microcreatures.

How a seemingly unsightly ditch by the roadside can suddenly sprout them over night after a rain is one of the mysteries of Nature. In fact, the adherents of the "spontaneous generation" school would have had abundant evidence to support their theory of life's origin had they had the magic eye of the microscope in Medieval times. And yet you with your unaided eye may be able to detect such little specks of dirt floating idly in the water. With the slightest disturbance these particles spring to life and dart madly out of sight. No doubt you will be looking at your first rotifer.

Rotifers are the heavyweight dynamos of a drop of water. You cannot describe one as you would a bird or beast of our macro-world. Frederick Eichhorn, an itinerate German naturalist, gave the animals a description that has survived for nearly two centuries. In 1781, he called one such organism the "crown polype," alluding to its long spines and gem-studded appearance. Furthermore, he likened the "incomparable animal" to a pomegranate blossom. Neophyte microbiologists still give the same amazed exclamation as some of the pioneer biologists have done when they look upon these curious creatures cavorting in a drop of water.

My first experience with these minute animals filled me with both delight and despair. The varied and fantastic forms, the brilliant colors and lively mannerisms once held me spellbound for three hours. To those who have never gazed upon such an organism, a lively experience awaits them. Their variety and complexity of structure make a formal definition impossible.

Nature has designed some marvelous devices in animals that man has imitated in one form or another. The turbine principle employed by the rotifers is probably the most ingenious. However, most rotifers have somewhat elongated bodies with a ring of lashing hairs, or cilia, at the front end. These cilia give the head the appearance of a minute rotary cog-wheel, or turbine, and by whipping and pushing against the water, they also provide the primary means of locomotion for rotifers.

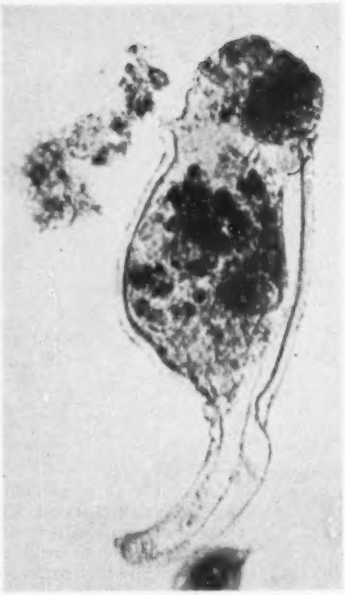
At the tail end of the animal, the body is extended into a process called the "foot," which usually has two small terminal projections called the "toes." The foot may lash severely in the water, but any motion given to the rotifer by this lashing is just as useless as that of a drop of fat in a hot frying pan. Just as the bird needs its tail to help guide and balance it while flying, so does the rotifer need its tail, or foot, to direct it while swimming. The toes, on the other hand, are used to clasp and hold to plants and other objects in the water like a pair of pliers. Sometimes the toes are modified into a curved disk, which fastens to plants like a suction cup.

The battle of the sexes among animals probably began eons ago when the rotifers came into being. Among them, the males have become small and degenerate over the ages, and many of them have even lost their alimentary canals, while the females have retained their size and vigorous stature. The male population now is so reduced that most of the tiny animate turbines that you will see will be brooding their eggs and caring for their young in much the same way as a mother robin.

One of the most numerous forms, however, does not show this "Maggie and Jiggs" difference between the sexes. These belong to the large family known as the Nommatids. Within this family there are many indi-

viduals that resemble each other so closely that a general description of one of them would apply to the entire family.

I began to doubt the ability of the human race among animals to be the most supremely adapted to its environment when I first examined a nommatid. There is a prominent brain in the front part of the rotifer's head, with various nerves leading to and from it. The brain itself comprises nearly one-tenth of the entire body. An average man would have to have a brain almost fifteen times as large as the one he already possesses in order to compete with the rotifer in brain size. Chief among the sense organs is the red-pigmented eye, located near the brain and responding quite rapidly to light intensities. Besides this highly adapted nervous system, the rotifer has an excretory apparatus that resembles that in the lowest animals. Again pointing up the contrasting mechanisms in this tiny creature is the lack of circulatory and respiratory systems. The rotifer then appears to be quite remote from a modern animal, and perhaps even primitive. Like the brain, the reproductive system is highly developed and the parthenogenesis taking place finds its place among the most recent of the evolutionary developments in life.



This is *Brachionus mollis*, with several large euglenoid cells near the foot. There is an antennae near the left (dorsal) side of the rotifer and the dark brain in the head is evident. These euglenae are much too large for this rotifer's diet, but their smaller relatives are ideal.

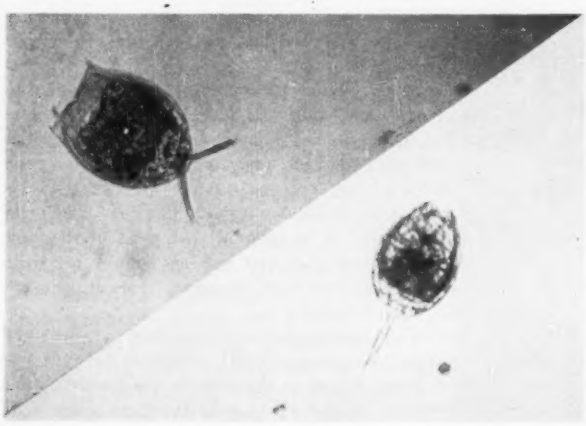
One afternoon, my microgazing transported me into the world of rotifers and tiny one-celled plants, and for the first time vividly revealed to me the silent awe and constant fear present there. Imagine yourself being carried by an unconquerable stream several hundred feet through its swift current into the gaping mouth of some huge sea monster. Such an idea may appear a gross exaggeration, but my impressions of the struggle for existence in the micro-world are based on cold hard facts. I compared myself to the tiny green euglena, a plant-animal organism of one cell, that entered the field of a rotifer's jaws.

There along the edge of the mouth the euglena surveyed its new conqueror. Suspended over it was a ruby-red spot in the rotifer that gleamed like a ball of fire and nearly twice its own size. Ahead of the euglena lay the rest of the rotifer — an immense animal, perhaps several hundred feet long (in comparison to our macro-world, actually only a fraction of a millimeter) and covered by a thick shell resembling unbreakable glass.

Tapping around with its flagellum, the euglena found a current of water flowing back over the rotifer's body. The tiny green cell tried to force its way into this current and thus be carried past the creature. But when it moved, the rotifer suddenly jerked and the euglena fell, struggling, into its mouth. Once inside the mouth, the euglena swam eagerly for the thick folds of muscle that lined the inside. For a while it steadied itself in this new position along the wall in order to discover into what peril its spinning clumsiness had lead it.

The cavity of the rotifer's mouth, somewhat cup-shaped, would be as large as a room if the micro-creature were enlarged proportionally to our size. From its position along the rim, the euglena could detect the slow ooze of a fluid from a small hole near the bottom of the cup. The bottom wall of the mouth suddenly opened down the middle, exposing two rake-like jaws with long curved spines on either side.

Some cells that had been freed from a colony of volvox, a large spherical family of animate cells wrapped in a jelly-like substance, came streaming into the mouth and was pulled by the spines into the jaws. The jaws closed



This photo shows the similarity of structure of *Lecane* on the left and *Monostyla* on the right. The feet in both animals have been reduced to a bulbous knob on the lower end, while the toes are much elongated. Both animals have broad, flat shells.

slowly, at first only a little, as if to make sure that the cells were still there, then they closed completely. With a deliberate rocking movement, the jaws pressed against each other, then swung open; the euglena seemingly fluttered at the mass of remaining pulp. Were it not for the very primitive status of the euglena in the realm of life, I would have sworn that it realized completely the situation.

In a wild frenzy the green, one-celled creature left its position in the muscle and began a maddening battle to escape from the gigantic mouth, but the lashing ferocity of hundreds of strong cilia surrounding the outside of the mouth and the inward current that they created made an escape impossible.

Exhausted, the euglena was no longer able to compete against the forces at the rotifer's disposal, and little by little it slipped downward; past the rim where it was once able to stay without danger; past the folds of muscle, which extended like the ribs of a dome around the mouth; past the small hole from which the fluid oozed and which now seemed to gush like a broken hydrant; past the last hope of escape. With a final twist of its flagellum, the euglena fell helplessly between the open jaws of the rotifer and like two heavy tombstones, they rocked slowly together.

Although the much smaller creatures, mostly one-celled plants and animals that make up the diet of the rotifers, are in no way capable of sensing the situation in the same way as humans, there is no doubt that the predator-forage struggle is as realistic. Often I have watched a tiny flagellated protozoan struggle vainly to escape from the wild currents that drew everything within a radius nearly equalling the length of the rotifer into its mouth. But, as with the euglena, there was no escape once the hapless victim is within striking range.

An aura of mystery often pervades the origin of unseen creatures in a drop of water. One day a group of fellow "hot-rod" microgazers accompanied me on a collecting trip. Along the side of the road was a pond several feet wide and with little or no vegetation. I asked one of my companions to fill a sample bottle with some of the pond water; he quickly complied, then suddenly turned in his tracks.

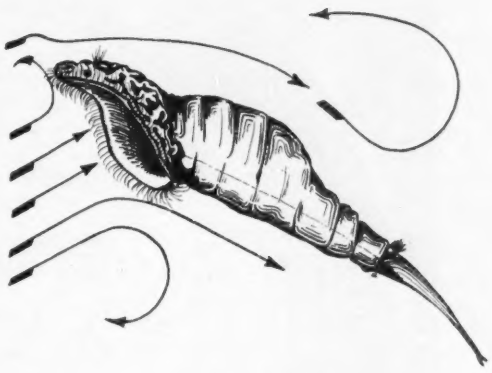
"How are you going to get anything in this water? I was past here yesterday afternoon and this field was as dry as a Ry-Krisp."

"I know," I replied with an unusual amount of professorial dignity, "but it rained last night."

"So instead of raining cats and dogs, it starts raining rotifers, I suppose."

This attitude is not surprising. Actually the rotifers were not carried to the pond in the rain, and probably not even by the rain, but were present as eggs in the soil since the last generation died out when the pond dried. Although the adults cannot withstand severe changes in environment, the eggs are very resistant.

The production of eggs is a striking and unique process among the rotifers. During favorable conditions,

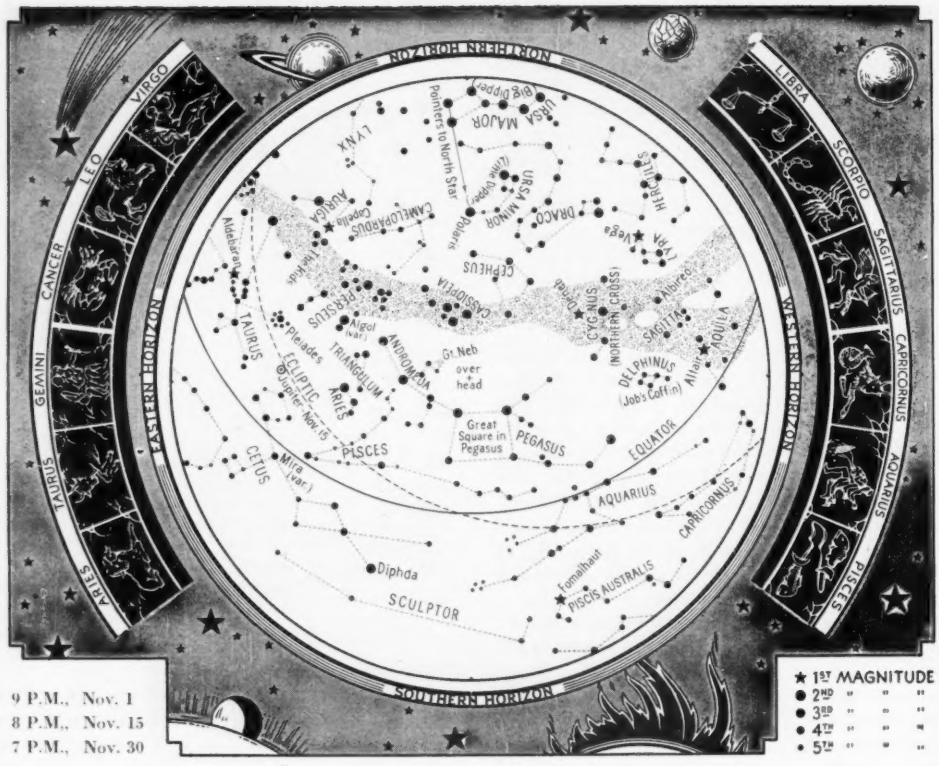


This diagram of a *Rhinops vitrea* male shows the currents of water created by the cilia around the mouth. The currents pass into the mouth and back over the body. Notice the eye beneath the dorsal antenna on the "roof" of the head, and the copulatory organ between the foot and the last "segment" of the body.

the females produce eggs that develop without fertilization into more females only. Many generations of mothers and daughters may follow until some change in environmental conditions takes place. Then some of the females produce eggs that develop into males. These males, in turn, fertilize some of the female eggs and they develop a thick, resistant, cyst-like shell. These armour-clad eggs can survive drought and freezing and may be blown around by the wind in the same manner as the bacteria.

If the rotifers are everywhere abundant, what kind of rotifers would we expect to find in the Orient, or in South Africa, or in Australia? If the physical and biological conditions are the same in ponds in the three continents, then the rotifers may be the same or very similar kinds, regardless how far apart the ponds are. But if conditions are different, the populations will be quite different, even if the ponds are next to one another. Since conditions of the water are the important factor, you can easily guess that from early spring until late autumn, a pond may have many changes in the kinds of rotifers that live there.

Although rotifers hold no economic or social significance, nor have they as yet been of any medicinal or pharmacological use, these tiny creatures offer to the layman a most fascinating and educational hobby with no more expense than a good hand lens. And to the student they offer an excellent and plentiful source of material for studying the phenomenon of reproduction and behaviors in lower organisms. Who will be the first to explore these tiny turbines for possible answers to some of the perplexing problems in medical research?



To use this map hold it before you in a vertical position and turn it until the direction of the compass that you wish to face is at the bottom. Then, below the center of the map, which is the point overhead, will be seen the constellations visible in that part of the heavens. It will not be necessary to turn the map if the direction faced is south.

A Visit to the Moon

By ISABEL M. LEWIS

IF AN inhabitant of this planet could make a safe and speedy round-trip to the moon, with the knowledge that safeguards had been devised that would insure his survival during a brief sojourn on a world where all that is essential to his existence is lacking, his adventures would be the beginning of a new and unparalled era in history.

A general knowledge of what one may expect to find in the way of surface features on the moon could be gained from many excellent maps of the moon and from numerous photographs taken with the aid of powerful telescopes. The latter show markings down to the most minute craterlets and crater pits less than a mile in diameter, and the finest networks of clefts and rills.

To all this advance information, we must add the ominous knowledge of the vitally important fact that the prime essential to life — an atmosphere — is totally absent on the moon. However, we will assume that the visitor has safely landed upon a world appallingly different from our own.

A ceaseless and annoying pelting with small meteoric particles and an occasional larger stone is a minor disturbance that one is spared upon the earth's surface because of the protection our atmosphere insures. On the moon this meteoric substance of all sizes, from small grains to huge meteorites, is found everywhere. The visitor stumbles, also, over rubble and rocky debris wherever he goes, and walks through volcanic ash heavily deposited in some parts of the surface. There are many signs of great flows of lava in past ages and much of the surface is pumice-like.

Lofty mountain ranges, with great towering peaks, many of them three miles or more in height, which,

under a low sun, cast for distances of many miles harsh, cold, black shadows, appear in distant backgrounds. Towering peaks are in fact everywhere—on the edge of crater walls and rising singly, or two or three together, from the centers of their floors.

Even though he may be heavily ladened with equipment essential to his survival on the surface of the moon, the visitor finds he has a buoyancy such as he never possessed on earth. The low surface gravity on the moon, which is only 16 hundredths of that on our planet, means that his weight, if it were 160 pounds on earth, is now about 25½ pounds.

Although the visitor has brought with him the means of protection against lack of air and water and the great extremes of temperature he realizes what a tremendous range there is in temperature between lunar midday and lunar midnight. At the center of the side of the moon that is always turned toward the earth — since the period of rotation of the moon on its axis is equal to its sidereal period of revolution around the earth — it is known that the temperature at lunar midday is around 212 degrees Fahrenheit. At the same point on the surface at lunar midnight, about 14¾ of our terrestrial days later, the temperature has dropped to minus 238 degrees Fahrenheit.

Along the terminator on the moon's surface, which is the line seen creeping slowly across the face of the moon with its changing phases, and which separates the day from the night side, the sun is always rising or setting. The temperature along this line is about minus 60 degrees F. The reflecting power of the lunar surface is low, only about seven percent, which is about that of dark, brown rocks, and therefore a very high percent of the heat reaching the surface is absorbed; but in an absence of an atmosphere there is a rapid loss of stored-up heat. As there is no twilight, and no sunrise and sunset colors, since there is no atmosphere, a visitor standing at a point on the terminator would see to one side a lunar surface in deep, black shadow, although here and there he sees a brilliant point of light, the top of a lofty mountain peak in the distance reflecting the ray's of the sun. On the other side of him the lunar surface is bathed in the dazzling brilliancy of the sun's rays, except where long shadows of lofty objects lie across the landscape.

One of the most remarkable effects of the lack of an atmosphere, and one that would attract the attention of the visitor to the surface of the moon above everything else, is the inky blackness of the sky by day as well as at night. Stars shine brilliantly against a black background in the day, as well as night, as sharp, glittering, and untwinkling points of light, and there are myriad of them, countless more than are seen in our clearest of night skies on earth. The sun shines brilliantly against a black sky for there is no scattering or diffusion, reflection, or refraction, of sunlight by an atmosphere. This should be Paradise for an astronomer; for in addition to perfect "seeing" there are no clouds, no rains, fogs, or mists and the stars near the horizon are quite as clearly visible as overhead. There are no dense atmospheric strata along the horizon to dim their light. The solar corona, which shows to us its magnificent streamers only when there is a total solar eclipse, is always visible whenever the sun is above the horizon, and its remarkable changes in form and brightness with changes in solar activity, and particularly during the sun-spot cycle, would be a thing of fascinating beauty to observe. The sun would appear very different in color on the moon from what it does on our planet. The radiations of X-rays and others of short wave length, which our atmosphere traps or turns aside and scatters — producing the blue light of our sky in daytime — reach the surface of the moon with deadly effect to life exposed to them even for brief periods; and the sun beats down upon the lunar surface mercilessly for 14 terrestrial days at a time. This would be one of the greatest hazards a visitor to the moon would experience.

One cannot imagine a visitor to the moon spending much time on the four-tenths of its surface that is never visible from the earth, which is roughly circular in form and opposite the four-tenths area that surrounds the *center* of the visible surface and is *always* visible. The zone between the two and always along the rim of the lunar disk is one within which the earth is visible part of the time and invisible part of the time. It is the portion of the lunar surface which, in a periodic way, swings back and forth into visibility and invisibility from the earth, as a result of what is known as the librations of the moon, and the various causes of which we will not consider here. From what we can see of lunar features in this border region, although they are greatly foreshortened because of position near the edge of the lunar disk, there is no great difference between the *never* visible and *always* visible portions of the surface. Our visitor (Continued on page 500)

The Andromeda Nebula

By DANIEL SMYTHE

The spectograph breaks up this light
That fell for fifty thousand years.
Upon its coast of glimmering night,
We see the cloud-like mass it bears.

A corridor where runs the tide
Of interstellar dust, our glass
Is a small bridge that may divide
The way galactic systems pass.

Star clusters in far Hercules,
And others that are globular
We glimpse along with Pleiades;
We peer for the most distant star.

A well in which huge suns may burn
Is this sky, tense, miraculous.
A misty key awaits its turn,
Held out across the void to us.

The School Page

By E. LAURENCE PALMER

Professor Emeritus of Nature and Science Education, Cornell University, and Director of Nature Education. The American Nature Association.

STAR STUDY, A CURE FOR DEMENTIA

BY REQUEST the special insert this month is a reprint of an earlier number on the study of the sky at night. It is appropriate that, if we must repeat consideration of a Nature topic in this series, that it be with a topic as orderly, as constant as the study of stars may be.

Stars are, of course, studied variously in our schools. We may approach them through consideration of myths associated with them, but these seem futile, although perhaps interesting. We may consider the stars as do the astrologers, and seek to find an interpretation of the present, and a prognostication of the future, in the position of the stars at the time some earthly event took place. It would seem that any reasonable investigation of this field would indicate its fallibility, yet we must admit that astrology has a big following. This page, then, is not concerned with the study of the starry skies at night through the eyes of the mythologist or of the astrologer.

Even if we consider stars from a sensible angle, and learn to know the facts about them, we as teachers may take a variety of approaches. I rather think that it is almost as futile to expect children to be intrigued by some of the material we offer them about stars as it would be to ask them to accept the teachings of the mythologist and astrologer. To be sure, we should know something about a light year, but can we really appreciate the distance involved in this astronomical unit of measurement? We can present figures regarding size, temperature, mass and behavior of many astronomic units, but usually these, too, are beyond the ability of the average person truly to appreciate. Why, then, try to be profound when we have not mastered the simpler appreciations that star studies offer us almost every night.

There are simple star studies that anyone can understand. Most Boy Scouts are exposed to the study of the Big Dipper and its relation to the North Star. Most Scouts are told to find the North Star with the help of the Dipper, in spite of the fact that it may be of little importance to know where North is if you do not know where you want to go. Most amateur star students who make a few simple observations notice that the stars do not seem to remain fixed, that apparently the Big Dipper does not remain in a fixed position. But how many of us who notice these differences ever try to use the positions of the constellations as a clock? How many have noticed, on their own, that the position of the Big Dipper tonight at 9 o'clock is approximately, but not exactly, the same as it will be at 9 o'clock tomorrow night? How many of us take the time to figure out that if the Dipper seems to swing around in a circle in 24 hours we can use its position for telling the time of night if we note its position at any starting point. Since there are four 6-hour units in the 24 hours of a day, it is obvious that in a 6-hour stretch the constellations will take approximately a quarter of a complete turn about the Pole Star in that time. In three hours it will make an eighth of that turn, and so on. I think this use of the polar constellations as a clock has intrigued me more than anything else I know about star study. Many a time when I have been camping out I have taken a glimpse of the Big Dipper just before going to sleep. Then when I wake some hours later I can, without the help of my watch, make a reasonable guess as to what time it may be. It is worth while having something constant, like the position of stars, to fall back on these days when so many other things lack constancy.

Not long ago I spent a day in our national capital. As my train came into the city at night a window was broken by a flying stone just two seats to the rear of me. The taxi driver who took me to my hotel said that he had been driving steadily for 18 hours and then expected us to ride in comfort in a milling traffic. In the morning a friend who had asked to have an early breakfast with me did not show up until 9:30, although I had been waiting patiently for him since 7:30. We attended a meeting in a government office but the information clerk in the building was unable to tell us where, although she knew the meeting was a big one and was being held somewhere in the building. The presiding officer, when we finally found him, opened the meeting with a eulogy to a cabinet officer for whom I had little respect. Our large group was broken up and my group was directed to a room that we found was being completely redecorated, and so the day went. When I returned to my hotel I found a telegram to the effect that a close relative was in the hospital but everything was all right. During the day we spent most of the time discussing the importance of an international viewpoint in our educational programs. Shortly before we were to adjourn we managed to get back to discussing the importance of our home problems. At this point a government official came in, listened to the discussion for not more than five minutes and then, in spite of the fact that he had not been with us before, suggested that we should not overlook the international possibilities of an educational program.

This day in dementia, spent in a city where I should have developed confidence in the stability of our government and of its leaders, was just about too much for me. I write of it here simply because of what followed. Because of the telegram I caught the first train home, not knowing what I would find when I got there. I remember waking in the night worried about the immediate future. Off above the horizon I saw the constellation of Scorpio. I knew the direction in which it should lie at that time of night and at that time of year. For the first time in 24 hours I saw something that gave me poise. I dropped off to sleep. Some time later I awoke and again glanced out the Pullman window. There again was Scorpio, but this time it was at a different angle to the horizon. Surely I was worried about things in general, but I put my mind to work on determining about how long I had been asleep between the two glimpses of the constellation. I did not even need to glance at my watch. I *knew* that what the stars told me could be depended on more than could a man-made machine in my hands. At last I had confidence in something. With that confidence on my part the dementia of the day vanished into the darkness and I was soon sleeping soundly. I have since wondered what might have happened had I not seen Scorpio. I might have continued to worry about what the next day held. I might have continued to bemoan what the previous day had brought to me. I might have damned individuals, institutions and situations. Instead I was back on an even keel. I was master of the situation. I went to sleep.

Suppose that instead of having the habit of using Scorpio and other constellations as a clock I had fallen back on the astrologers' approach, or had tried to call to mind some myth about the constellation. It could have given me none of the sense of security that I got from making two observations at different times, noting changes that took place during that time, remembering what should have happened during that time and reaching a conclusion that I knew was rational.

I mention this because I know that star study of a sensible sort can do much to restore confidence in the orderliness of Nature these days. Do not give your children a lot of myths and superstitions about stars. Do not even fill them up with figures that they cannot appreciate. Just start off with things that you can see any starry night in the space of an hour. Note the position of a constellation in relation to a treetop or a church steeple. Note the change that takes place in a half hour, or even 15 minutes, and predict what change can be expected in a similar extension of the time into the future. Check what happens to your prediction. Get this habit and you will have something to which you can pin your faith, no matter what happens to Russia, your political party, or your neighbor's kids. Frankly, I doubt if there is anything better as an antidote to dementia than a good strong dose of star study. Try it with the help of this month's insert, the star finder provided there, and the stars that you should be able to see tonight and every clear night.

Garden Wild Flowers

Wild Flowers for Your Garden. By Helen S. Hull. New York. 1952. M. Barrows and Company. 280 pages. Illustrated. $4.95.

Making wild flowers prosper in the garden is a tricky business. However, with the inroads of "civilization," many normal habitats for wild flowers are being destroyed, and it may well be, with some species, that they will be found only in wild flower sanctuaries or similar reservations, and in hospitable home gardens. Often wild flower lovers have seen, with a feeling of despair, development move in to destroy a favorite area. With the aid of this excellent and practical book it would be possible to transfer the threatened plants to safer ground and continue to enjoy them. The text, which is full of the author's own affection for wild flowers, contains information on raising them from seeds or cuttings, deals with soil and surroundings, and discusses fully fifty of the most popular and dependable wild flowers.

Pet Skunk

Meph[illegible]ue Pet Skunk. John and Jean George. New York. 1952. E.P. Dutton and Co. 180 pages. Illustrated by Jean George. $2.75.

The authors of this little story are naturalists and also the authors of several other stories of wild animal life. Thus this fictionized account of a pet skunk is based upon accurate knowledge of these animals. The Georges make a fine writing team, and their growing list of entertaining Nature books for the younger folk attests to their popularity.

Life Problems

Problems of Life. By Ludwig von Bertalanffy. New York. 1952. John Wiley and Sons. 216 pages. $4.00.

This book carries the subtitle "An Evaluation of Modern Biological Thought." The author has long been advocating a viewpoint of biology called the "organismic conception." This book is based upon his practice and theory in this field, and holds that "biology is an autonomous science in the sense that its problems require the development of scientific conceptions and laws; further that biological knowledge and conceptions are active in different fields."

Any Suggestions?

As a new resident of Pittsburgh, one who signs himself J.L.B. writes to the editor of the *Pittsburgh Post-Gazette*, complimenting the city on various things, including its "lush green vegetation." The writer then says:

"But the trees, beautiful in themselves, bring on another problem which seems to have been overlooked. That is the bird pest. Surely, in a forward-looking community such as this, there must be someone who can step forward with a suitable way of cleaning out the unwanted bird life that is such a nuisance. Birds are all right in their place, out on a farm, eating worms and insects. They are out of date in a modern city. I am not referring only to the sparrows and pigeons, either, but the other noxious feathered creatures that clutter up our trees.

"The robins are bad enough but the cardinals are by all odds the worst. I never, thank goodness, encountered them till I came here from the West. The maddening repetition of their monotonous, rasping chant outside my window awoke me all spring. If the city fathers don't have the money to clean all of these feathered nuisances from town, can some reader tell me how to clear them off my premises?

"A friend of mine tells me he has used an ordinary wire rat trap with success. He baits the trap with sunflower seeds and when the cardinal hits the trigger he is neatly, painlessly dispatched. However, the method is slow and troublesome. There must be a better one."

Hatteras Seashore

With $618,000 in State of North Carolina funds and a matching amount from unnamed donors, the National Park Service has launched the program of acquiring the area that will become the Cape Hatteras National Seashore Recreation Area. The portion of the Outer Banks of North Carolina to be set aside comprises one of the few extensive stretches of undeveloped seashore remaining on the Atlantic Coast. About thirty-thousand acres will be involved in the acquisition.

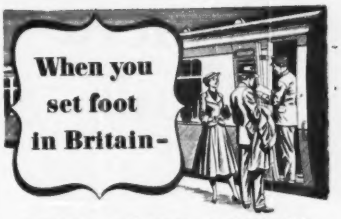
Products

"Weldit" is the trade name of a cement that stops leaks, waterproofs, cements materials, insulates, and caulks. It is the product of Singer Home Products, Jamaica 4, New York, and will be distributed through hardware, drug, variety, department, sporting and hobby stores. . .Brumberger Sales Corporation, 34 34th St., Brooklyn, New York, announces new slide cabinets and slide files. . .Almanac Films, 516 Fifth Avenue, New York 36, New York, announces release of 17 new films on Nature study and science, produced with John Kieran.

Golden Trees

Trees. By Herbert S. Zim and Alexander C. Martin. New York. 1952. Simon and Schuster. 158 pages. Illustrated in color by Dorothea and Sy Barlowe. Soft bound, $1.00; cloth bound, $1.50.

This is the fifth in the series of "Golden Nature Guides" and maintains the high standard set for this group of inexpensive guides to the more common Nature forms. In this pocket book 150 species of trees are covered. The illustrations show shapes, typical habitats and details of twigs, buds, bark, leaves, seeds and flowers. Small maps show the distribution of the trees. A simple key is included.



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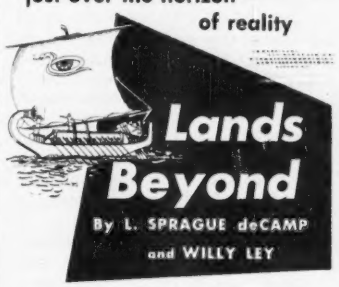

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Camera Trails

By
EDNA HOFFMAN EVANS

IT IS time to be thinking about Christmas cards again. Whether you plan, design, and print your own, or merely take a favorite snapshot down to the photofinisher and let him do the rest, it is high time you were getting at it.

If you are going to do the latter, there is not so much work to it. In fact, aside from deciding on a picture and hunting up the right negative, there is practically nothing more for you to do except pay the bill and then address the envelopes.

Advance reports from Ansco, published in the May-June issue of *Ansconian*, indicate that the company has prepared a new and appealing series of Christmas greeting masks, as well as Ansco greeting card special paper. Since the masks were announced as far ahead as last spring (business certainly is fore-handed in its operations, isn't it?) they are probably waiting for you at your dealer's right now.

According to the announcement, the new masks have been "tailor-made" to suit photofinisher preference, and of course photofinisher preference is guided by what the ultimate consumer wants. "The choice of sentiments," so the announcement goes, "the type of art treatment, the placement of the various elements on the mask with respect to the picture opening — all of these and other factors were decided only after taking production and printing requirements into account."

All the Ansco masks are for standard 4¼ x 5½-inch print size. They are arranged to fit both vertical and horizontal negatives and some of them are suited to accommodate full 120, square 120, and full 127 film sizes. The cards have deckled edges and envelopes to fit.

Leaving the work up to the commercial finisher is simpler, but printing your own Christmas cards is lots more fun, providing you have the time to spare and the patience to do it. I will admit that the job begins to get a bit tedious along about the sixty-ninth or the seventy-second card, but maybe the personal touch you give and the personal satisfaction you derive will be worth the effort.

Assuming that you are starting from scratch with this Christmas card business, how do you go about it?

The first thing to do is to decide what you want your card to say — not with words but with a picture. The possibilities, as you can readily see, are endless. The Nature photographer, particularly, has a wide range of subjects to choose from. He can use animals, birds, scenes, people, or any combination of these. He can also build his own settings in the form of tabletop arrangements, or do a montage of several photographs.

Since I live in the West for about three-quarters of every year I usually try to make my Christmas cards characteristic. Two of the illustrations show what I have done to that effect. The covered wagon, I must admit, never felt the pull of a yoke of oxen or heard the crack of a pioneer's whip. It is a stage setting left over from a wild west movie, but it made a good set-up for a Christmas card.

The corral, on the other hand, is a real one, although there were not any broncs, steers, or other critters in it when the picture was taken. I simply set the camera on a tripod, focused it, and adjusted the lens aperture. Then I climbed into place and had a friend trip the shutter. Since my friend scarcely knows one end of a camera from the other, and since my dog sometimes gets rather bored with posing, we took about eight shots, using various poses, to make sure we got a good choice of pictures. It is a good thing we did take that many because there were three double exposures in the lot. But the others were pretty good and from them I chose the best.

The writing was added when I printed the cards. To do that, I used a sheet of blank film (unexposed film cleared in hypo). On it I wrote the greeting with a fountain pen, spacing the words so that they fitted into the proper place on the other negative. Then I put both negatives in the enlarger. Pen and ink writing does all right, but it is rather difficult to get uniform coverage on all the letters. The ink is thin in some places and heavy in others. This, however, does not show too badly if you do not "blow up" the picture to any great extent.

The dog picture — yes, it is a live pup, a four-week-old French poodle named Twinkle — was posed purposely as a modified tabletop set-up. Twinkle was white and the imitation Christmas tree was white. The background was dark brown cloth scotch-taped to the wall, and the checkered cloth base was used to give variety. I used three lights, two at the sides for general illumination and one low and close to Twinkle. Getting detail to show on an all-white dog is no easy task, and printing it after you get it is another chore.

The greeting on this card was made by photographing white letters arranged on a black background. Both the letters and the shiny black backing come from a special kit that can be purchased at any photo shop. The negative, then, was used along with the Twinkle negative, as was described above. The 1951, of course, definitely dates the mask and it cannot be used again for any later year.

The fourth card shows, I think, what

can be done with posterpaint and a picture window. The window actually is a window on which the boy in the picture painted the scene with opaque water colors. The snow was white, the trees were green, the house red, and the path black. Then there were white snow flecks on the rest of the window.

The "Season's Greetings" was cut from black paper and pasted on the window. The words, incidentally, were to be read from the outside so, viewed from the inside, they were backwards. Later the negative was reversed in the enlarger so they read as they should on the print.

The boy sat by the window, pointed to the greeting, and the picture was taken. The camera was inside the room, held rather low to avoid including the house

across the street. The natural daylight came from outside and everything was silhouetted against it. This idea can, of course, be used in many different situations.

You can buy the deckle-edged cards and envelopes at a camera shop in any number you wish. There is some small choice as to paper; some papers permit toning and some do not. If you are a real eager beaver you can tint your pictures, or add a touch of color in some way or other.

You may also be able to buy commercial masks, such as those prepared by Ansco. Eastman also has a line of them. However, I think you can have a more personal, individual, and distinctive card if you design your own mask.

Just be sure that you allow yourself enough time to get the cards ready. If you make more than fifty of them, you may need more than one session in the darkroom. Then there is the time required for the prints to dry and, once dried, be sure to weight them down for (like all prints) they have a definite tendency to curl.

The mail man will appreciate getting them as early as possible, so do not wait until the last minute to address and stamp them. Then, once they are in the mail box, you can sit back, heave a sigh, and rejoice that one of your holiday jobs is successfully and satisfactorily completed.

MORE CATS — AND DOGS

The dog and cat portrait sections of last spring inspired another letter that arrived recently. This one was from Mary Gamble out in Bozeman, Montana. Mary inclosed three snapshots, two of them of dogs showing facial expressions ranging from "a grin to pathos," as the youthful photographer termed them. The third was of a yawning cat. Mary agreed that "cats will not pose," and added that while she has taken quite a lot of cat snapshots, this was the only time she was ever able to catch one yawning.

FILM GUIDE

I have been looking over the twelfth edition of the *Educators Guide to Free Films*, published by the Educators Progress Service in Randolph, Wisconsin. This publication has really become a visual aids bible, listing as it does the titles and sources of a vast number of educational films. Each year the new edition gets larger than its predecessor. The twelfth edition lists 2332 film titles, 538 more than were listed last year. For schools and other organizations interested in low cost visual material, the guide is a veritable gold mine of information.

COMPANY HISTORY

The mail also brought an interesting book entitled *Du Pont — The Autobiography of An American Enterprise*, prepared in connection with the company's 150th anniversary. It is the story of American development from the days of the small, individually owned enterprise to the present, when most phases of life have grown too large and too complex for any one individual to manage them.

"Du Pont" has always been a rather vague name in my mind, connected remotely with war munitions, rayon, and various kinds of photographic products. I never knew before that the first Du Pont was a French refugee who did not particularly like the way things were going under Napoleon.

Before leaving France the young emigre for a time had been associated with Antoine Lavoisier, the great French chemist, and had learned the technique of making gunpowder. Then the guillotine took Lavoisier's head and along with it went Du Pont's job. Some years later, when Du Pont moved to the New World, he found the gunpowder there to be pretty sorry stuff (imagine facing Indians and all the terrors of the wilderness with ammunition you could not depend on). So

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Even Old Santa draws upon the wealth of Nature subjects to fill his bag of gifts. He is a busy fellow and sometimes gets a bit careless. Sometimes the only compliments his gifts are worth are the compliments of the season. He has a big heart, but occasionally needs a suggestion.

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he decided to build a powder mill. President Thomas Jefferson favored the enterprise, and Paul Revere was in on the deal, too.

The book goes on from there, tracing the company's history in picture and in print, from the days of black gunpowder to the days of nylon, plastics, and synthetic substances of many kinds for many purposes. I wish a few pages had been devoted to the products used in photography but, none the less, it is an interesting book and I am glad to have a copy.

PET PATIENTS

(Continued from page 460)

by the terrifying spectacle of a skunk facing in the opposite direction!

We felt the time had come. Medical man though I was, I demurred at playing surgeon to a skunk and our local veterinarian had the same idea. However, he gave us the address of a "specialist." We telephoned for an appointment and ascertained the fee, which proved to be "a dollar for commercial purposes, fifty cents if it's a pet."

A fearful and tearful Peg, accompanied by her pet, who was carried inside a skunk skin muff, started off with the rest of us to the brave doctor's house. My family had insisted on my carrying my own little black bag complete with sufficient material with which to operate on all the skunks throughout the country.

The veterinarian, a handsome man of about seventy, looked quizzically at Peg's muff when he opened his door to us.

"It looks as though someone has beat me to it," he remarked.

Whereupon Schmelling popped his little black and white head out of one end of the muff.

"So that is the patient," said the vet. "Aren't you a little careless with him?"

Peg pulled her pet from the muff, pressed him lovingly against her face, and held him tearfully toward the doctor, who took several quick steps backward.

"How old is he?" he asked, nervously.

"Two months old. At what age do they become dangerous?" asked my daughter.

"As soon as they're born," he replied. "You certainly are a lucky girl to have such an exceptional skunk. This is the second one out of hundreds I have handled that has such beautiful self-control."

The operating room proved to be a low stump on a grassy knoll. The vet carried a cigar box with him. I carried my doctor's bag.

"What's that for?" he asked.

I explained how my family had been afraid he might run out of medical equipment.

"Put it away," he ordered, smiling. "I have my own operating instruments."

The rest of the family were asked to vacate the scene of action. Schmelling was wrapped in an old gunny sack, leaving exposed only the vital area. The veterinarian then opened his cigar box, extracted a tube of vaseline and an ancient jack-knife and after emptying the glands of their dynamic fluid, performed the necessary amputation. The whole thing was finished in a matter of seconds and a smell-less Schmelling, wrapped in a clean white sugar sack, was handed to his owner.

"Pretty work," I commented.

"Been doing that operation for nearly fifty years. Should know how to do it by now," was the somewhat gruff rejoinder.

Schmelling never suffered any ill effects from his visit to the surgeon. He had no infection and his wounds were healed within a few days. He never seemed to object to his so-called captivity and the call of the wild never reached his ears. In fact, he lived happily ever after.

And so did we!

THE PHEASANT-TAILED JACANA IN KASHMIR

(Continued from page 468)

to four at least, but to my amazement she paid yet a fifth visit. For a few seconds she gazed at the now empty nest, surprised, so it seemed, to find no more eggs there, then turned and scuttled hurriedly to her new nest.

Before leaving I went to look at the new nest and saw the four lovely eggs, resting on a few bent reed stems, their sharply pointed ends together in the centre.

DEEP GO THE ROOTS

(Continued from page 484)

The deep-rooters can thus draw out at least twenty-seven inches of stored moisture during the growing season, less what is lost by evaporation from the top six inches. On the average, the nine feet of soil and rotten rock at any time during summer will contain perhaps half that much water. Thus the small pores will have room to take in and store around 14½ inches of rain. In a very heavy thunderstorm some of the hard driving rain will not be able to pass through the tighter soil layers below as fast as it enters the more porous surface, and the water will start moving downhill a short distance below the surface. Where live and decayed roots are present, however, the numerous channels they form will permit considerable water to enter even the tighter layers.

If the plants growing on the same kind of land had roots that went only three feet deep, it would take only four and one-half inches of water to fill up the half-empty small pores. In that case the water from a five-inch rain would produce a quick rise in the creek, whereas no rise would occur — except from rain falling into the stream itself — where the deep-rooted plants remained. This is one of the reasons why Piedmont streams like Rock Creek flood more often after the wooded land has been cleared and put in shallow-rooted grasses or cultivated crops.

Bulletins Received

"The Fern Genus *Diellia*, Its Structure, Affinities and Taxonomy" by Warren H. Wagner, Jr., is published by the University of California Press, Berkeley, California. It contains 167 pages, plus plates, and sells for $3.00. . ."Tularemia, Weather, and Rabbit Populations" by Ralph E. Yeatter and David H. Thompson is a Bulletin of the Illinois Natural History Survey, Urbana, Illinois. . ."Age, Growth, and Production of Yellow Perch in Lake Erie" by Frank W. Jobes is Fishery Bulletin 70 of the Fish and Wildlife Service, available from the Superintendent of Documents, U.S. Government Printing Office, Washington 25, D.C., for twenty cents. . ."A Review of Nomenclatural Conservation in the Algae from the Point of View of the Type Method" by Paul C. Silva is published by the University of California Press, Berkeley, California, at $1.25.

Feather Collection

Margaret Griebe's suggestion about collecting dragonflies, in our June-July issue, brought us another interesting suggestion for collecting by youngsters, and oldsters, for that matter. Mrs. Harry A. Pittenger of Alvin, Texas, writes us about an interesting collection of feathers made by her son, David. He has gathered, by dint of bright eyes and without the sacrifice of a single bird, a collection of more than one hundred different bird feathers. These were found in the fields or woods, where a bird may have been taken by a predator, at the bases of trees in which birds were nesting, or have been sent him by interested friends. David mounts the feathers with acetone glue on heavy paper in a looseleaf book, together with a picture of the species from which the feather came and other data. His knowledge of birds and their structure has thus been widely extended. It is a most inexpensive and informative hobby.

Michigan Ferns

Ferns of Michigan. By Cecil Billington. Bloomfield Hills, Michigan. 1952. Cranbrook Institute of Science. 240 pages. 17 halftone plates; 81 line cuts; 101 state distribution maps; 9-page pictorial glossary. $5.00.

Fern allies, rushes and club mosses, are included in this excellent identification guide to the ferns of Michigan. It will serve both the layman and the professional botanist. It is so planned that identification is simplified, and the book is a distinguished addition to the list of fine publications brought out by the Cranbrook Institute. Its value extends beyond the borders of Michigan, although it is definitely designed as a State publication.

Anthology for Anglers

An Angler's Anthology. Edited by Eugene Burns. Harrisburg, Pa. 1952. The Stackpole Company. 147 pages. Illustrated by Louis Macouillard. $5.00.

Throughout prose and poetry the sport of fishing has inspired many great writers, as it has many lesser lights of literature. While serving as an English instructor at Harvard, the editor of this work, both an angler and a scholar, had access to the Fearing Collection in the University Library. So he set about compiling choice excerpts from literature about angling. These and writings of leading writers on the outdoors have been included in this attractive and fascinating volume. Any fisherman with a literary bent will find joy in this book.

Fun with Trout

Fun with Trout. By Fred Everett. Harrisburg, Pa. 1952. The Stackpole Company. 287 pages. Illustrated in color and black and white by the author. $7.50.

Here is a beautiful book that will delight any fishermen who ever wet a fly in search of a trout. Fred Everett, artist, writer and angler, does not subscribe to the theory that trouting is an occult science to be veiled in mystery. So he sets about to discuss the sport in its true simplicity. No doubt he will start an argument among trout fishermen, but it cannot help but be an enjoyable discussion. Here is a book that is fun to read and full of information at the same time. And Everett's illustrations round out the volume, which is the answer to the question of what to give as a gift to a trouting friend.

Juveniles

Eight attractive and colorful little books come in one package from Avon Publishing Co., 575 Madison Avenue, New York 22, N.Y., and are the first in what promises to be a considerable group to be known under the name of "Jolly Books." Those in hand are *Boo, the Little Indian* by Peter Abbott, with illustrations by Kendall O'Connor and Bruce Bushman; *Tippy Runs Away* by Inez Bertail, with illustrations by Sylvia Holland and John J. Knight; *Tuffy the Truck* by Rose Wyler, with illustrations by Basil Davidovich; *Spoodles, the Puppy Who Learned* by Irma Simonton Black, with illustrations by Bob Totten; *The Magic Key* by Mary Francis, with illustrations by Sylvia Holland; *Please Come to My Party* by Susan Otto, with illustrations by Duval Eliot; *Jumper, Santa's Little Reindeer* by Terry Shannon, with illustrations by Charles Payzant; *Moko, the Circus Monkey* by Charles Payzant, with illustrations by Ted Parmelee. These books, which are slanted for the under-ten audience, carry no price, which indicates that their outlet will be through stores.

Nature Atlas

Hammond's Nature Atlas of America. By E. L. Jordan. New York. 1952. C. S. Hammond and Company. 256 pages. With 320 color illustrations by Walter Ferguson and John Cody; 34 pages of colored maps. $7.50.

Following a chapter entitled "Where to See American Nature Best," this large-sized book presents maps showing locations of national parks, national forests, state parks and other reservations. It then proceeds to chapters dealing with minerals and rocks, trees, wild flowers, birds, mammals, fishes, amphibians and reptiles, insects and climate. The color illustrations are simple and designed to show off the subject as clearly as possible as an aid to identification. The illustrations range from good to fair, some of the mammal pictures showing the greatest weaknesses. The text accompanying each picture is popular and concise, and every effort has been made to check it for accuracy with authorities in the several fields covered. The index provides ready reference to the subjects treated.

Vet Guide

Dog Owner's Veterinary Guide. By G. W. Stamm. Published by the author at 827 Greenleaf St., Evanston, Illinois. 1952. 112 pages. Illustrated. $1.00.

This little paper-bound book is designed to aid the dog owner in the prevention, diagnosis and treatment of the diseases of dogs. The text is popularly written and useful to the layman.

Herbs and Spices

The Home Garden Book of Herbs and Spices. By Milo Miloradovich. New York. 1952. Doubleday and Company. 236 pages. $2.95.

Here is a book that has a triple appeal — to the gardener, homemaker and gourmet. In other words, it is a complete handbook on the growing, preparing and preserving of culinary herbs and spices.

Ronnie by Rowntree

Ronnie. By Lester Rowntree. New York. 1952. The Viking Press. 188 pages. Illustrated by Don Percival. $2.50.

Miss Lester Rowntree has been a frequent contributor to *Nature Magazine*, writing primarily about wild flowers, since she is a botanist, collector and dealer in wild flowers. Her travels have taken her to many parts of the world, and much of her life has been spent outdoors in many different kinds of country. She knows Nature intimately. Being an able writer, she has now turned her hand to a novel for young people, creating a central character of Ronnie, who lives alone with his Aunt Sal in an isolated northern California mountain village. From such a base Ronnie has many experiences in the outdoors, about which the author writes delightfully and with authority. She takes Ronnie elsewhere, too, and his life is told about with warmth and understanding.

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Correction

Due to an error, for which NATURE MAGAZINE is in no way responsible, the price of 1001 NAMES FOR PETS in our advertisement in the October issue, was given as $1.50. The correct price is $1.25. Refunds are being mailed to all purchasers who sent in the larger amount.

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KINGFISHERS — SOVEREIGNS OF THE WATERCOURSES

(Continued from page 464)

pot-belly and the feet. The heels are covered by a callous-like pad of skin roughened by numerous small tubercles, which protect them from abrasion on the sandy floor of the dark nursery where they remain many days.

The parents share rather equally the task of nourishing the young. My pair of Amazon kingfishers brought their little ones, so far as I saw, only fish, which were nicely adjusted to the increasing size of the youngsters. At first the minnows were so small that they were difficult to detect in the parents' bills. Gradually they became bigger; and after the nestlings were feathered the parents brought many that were larger than their own bills. These were always carried lengthwise in the bill, head pointing inward. The nestlings swallowed them whole.

In common with motmots and many other hole-nesters, the parent kingfishers make no effort to keep the nest clean. When the burrow is in fairly dry, sandy soil, this absorbs the rather liquid excreta of the youngsters and prevents the chamber from becoming disgustingly foul. But the decaying nitrogenous wastes generate enough ammonia to make a man's eyes smart when placed close to an opening in the back of the chamber. Indigestible bones and scales regurgitated by the nestlings add to the accumulation already begun by the parents, and maggots infest this debris. Moreau's burrow of the half-collared kingfishers in Africa became so foul that liquid filth constantly oozed out of the entrance. The old birds disliked this; and when they emerged after feeding their half-grown young, they invariably plunged into the water to bathe. Usually they immersed themselves four or five times, but once eighteen plunges were recorded. At one nest of the Amazon kingfisher I saw the parents bathe in this fashion after visits to their nestlings; but I failed to observe this behavior at other burrows which were in lighter soil.

Young kingfishers never acquire any nestling down; but at the age of a week or so, when their eyes are opening, their pink bodies bristle with dark, horny feather-sheaths. These pin-feathers become quite long before they split and release the soft feathers that develop within them. Kingfishers linger within the burrow for a week or more after they are completely feathered. Since the tunnel may be situated high up in a vertical bank, or face a wide expanse of open water, a fluttering, incompetent departure might be fatal to the young fisher. I once watched a ringed kingfisher emerge from its natal burrow and cover two hundred feet, with a rise of about thirty, on its first flight. Since there is no space for wing exercises within the burrow, it is evident that the young kingfisher's wings can bear it aloft the very first time they are fully expanded. The kingfisher's period in the nest varies with the size of the species. The nestling period of the medium-sized Amazon kingfisher is about thirty days, but the big ringed kingfishers linger in their dark nursery until about thirty-five days old. Despite the often filthy state of their nest, young kingfishers greet the outer world in bright, fresh plumage, usually resembling that of their mother.

Not only can young kingfishers fly strongly as soon as they quit the nest, they can even dive. Within four hours of their emergence from the burrow where they had hatched, half-collared kingfishers plunged repeatedly into the pond, as though practicing the art of kingfishing! Once they have tasted the sunshine and the sweet outer air, kingfishers never return to their natal burrows.

Anglers often look upon kingfishers as competitors, and persecute them cruelly for taking the food which was their birthright long before men learned how to fish with hook and line. But recent studies have proved that kingfishers and other fish-eating birds perform a useful function in thinning out the small fry, which are produced in such multitudes that all could not possibly find enough food to grow to a size that would make them attractive to anglers. Thus in any body of water that is not polluted and not drained of its breeding-stock of mature fish by hordes of greedy fishermen, such birds improve rather than spoil the fishing. The concentration of vulnerable small fry at fish-hatcheries often attracts fishing birds, which zealous keepers shoot, or catch with cruel pole-traps. But it is now being discovered that it is on many scores better economy to screen the fish nurseries than to slaughter the visiting birds.

A TRIP TO THE MOON

(Continued from page 493)

to the moon would, doubtless, satisfy himself on this point. The fact, though, that the earth cannot be seen in the lunar sky would certainly lower lunar real estate values in that area, could one live on the moon; for as seen in the heavens from the earth side of the moon our planet would be a most beautiful and awe-inspiring object to behold. Seen projected against a background of inky blackness and countless brilliant stars, and presenting to the observer's fascinated eyes a huge rotating disk four times as great in diameter, and sixteen times as great in surface area, as the lunar disk in terrestrial skies, our planet viewed from the moon — with the possible exception of the sun — would be the grandest of all visible objects.

The earth would have the same phases seen from the position of an observer on the moon that the moon has to an observer on our planet, but in reverse order. It would remain fixed in position in the lunar sky except for a swaying back and forth in its motion that is produced by the librations of the moon. In the border zone of visibility this would bring it alternately above and below the horizon within the period of these librations. The position of the earth above the lunar horizon would be greater the nearer the position of the observer to the center of the visible side of the moon. At that point it would swing back and forth in the period of the librations through the observer's zenith. All the most conspicuous features of our planet would rotate into view in the course of the terrestrial day. What portion of the visible disk would be illuminated would depend upon the phase. At "new" earth, and "full" moon, all of the dark side of the earth is turned toward the observer, but its surface is lighted in a rather ghostly way by moonlight in which its night surface is bathed at this time. At time of new moon the earth has its fully illuminated day side turned toward the lunar observer. It is the phase of "full" earth as seen from the moon. Continents and seas, the contrasting features of the temperate zones, one in winter the other in summer season, or possibly spring and fall, present odd color contrasts and the snow caps and great glaciers of the frigid zones shine in brilliant white. The lunar observer studies, somewhat obscured though they are by our atmosphere, the wonders of this world of ours in space and from no other body in the solar system, he knows, can such a weirdly beautiful view be obtained.

On November 16, in the early hours preceding sunrise, one will see the maximum display of the periodic swarm of the Leonids. They will be moving very swiftly and bluish in color.

Mercury is at greatest eastern elongation on November 9, but this is an unfavorable elongation as it is very low in the southwest at sunset. It will be in inferior conjunction with the sun on November 30. Venus may be seen as an evening star in the southwest after sunset. Its position in the evening sky is improving rapidly. Mars is low in the southwest after sunset; receding from the earth, it passes from Sagittarius into Capricornus this month. Its brightness is now about that of a star of first magnitude. Jupiter is in opposition on November 8, and visible all night. It is in Aries. Saturn is in Virgo, north of Spica, and is visible in the southeast for an hour or more before sunrise.

The Egg

The Wonderful Egg. By G. Warren Schloat, Jr. New York. 1952. Charles Scribner's Sons. $2.25.

This is a picture story of the egg, whence it comes; how the chicken gets in the eggs; how it grows, and how the chicken gets out of the egg. Principal actors in the pictorial presentation are the author's two sons, Warren and Andy.

THE READER'S MARKET

A place where members of the American Nature Association and readers of Nature Magazine may find many interesting offerings or may advertise themselves, at low cost, for things wanted; things they have for Sale, for Trade, for Sale or Trade. This is an excellent forum for acquiring or disposing of such items as binoculars, books, cameras and photographic equipment, magazines, sports and outdoor equipment, etc.

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UNDER THE MICROSCOPE

By JULIAN D. CORRINGTON

THE MICROSCOPE MAKERS

IX. Carl Kellner

ONE of the world's major producers of optical instruments, the firm of E. Leitz, Inc., grew out of the mind and efforts of one man, as is so often the case, transforming a small village into a thriving industrial town. The man was Carl Kellner, born in 1826 at Hirzenhain, State of Hesse, Germany, and the community he was destined to influence so profoundly was Wetzlar, not far distant, in the Coblenz district of Rhenish Prussia.

Carl's father was manager of an iron foundry, and there was a decided industrial and managerial know-how that ran in the family. Young Carl attended Latin School at Braunfels, finding his province to lie in mathematics and physics, especially optics. Afterwards he continued his mathematics while working in a machine shop to acquire manual dexterity, spent two years in Hamburg at the Repsold shops where astronomical instruments were made and, when but 21 years old, produced his first invention, an eyepiece for field glasses and telescopes. This was a corrected ocular giving a wide and flat field and Kellner called it *orthoscopic*. Two years later, in 1849, he decided to move to Wetzlar and open up an optical shop, manufacturing field glasses and binoculars equipped with his new eyepiece, as well as providing them for use with telescopes.

At that time Wetzlar was a sleepy little village of 5000 persons, living on the memories of its once-celebrated Court, the house where Goethe had dwelt, and the Theatre so intimately connected with his *Werther*. Coaches brought tourists to see these attractions. Kellner remodeled a parsonage for his residence and shop and began turning out his products, which soon gained recognition among leading astronomers. The backing of these learned men, especially of the celebrated mathematician C. F. Gauss, in Göttingen, was an inspiration to the young inventor.

Repairing, remodeling, and manufacturing telescopes and their objectives and eyepieces now kept him busy, but he yearned to try his hand at a microscope, and so went on to turn out his first such instrument in 1851. Promptly this became the leading output. The ledgers show that he sold 28 microscopes in 1852, some going to the famous anatomist Bischoff. In 1853 he sold 39 microscopes, 40 the next year, and 34 the following year.

In a letter to Steinheil, of Munich, in 1853, Kellner writes of his models and prices. He offers three kinds for sale, the smallest, with two oculars and two objectives, gave magnifications of 90, 180, 360, and 720X, and cost 50 thaler; the middle sort added another eyepiece, ran the magnification up to 1000X, and the price to 75 thaler; while the finest model was equipped with three objectives and four oculars, enlarged up to 1200X, and cost 120 thaler. He adds that from 5 months for the simplest to 9 months for the most elaborate would be required for manufacture and delivery.

Proximity of the University of Giessen was of great assistance to the young optician, as the staff members at this institution were the first to recognize the excellence of Kellner productions, and to back up their opinions with orders. Professor Bischoff was probably his most influential sponsor, but the account books list ten others, including Leuckart, who were customers. Soon the word spread and we find entries of sales to the botanist Schleiden in Jena, the histologist Kölliker in Würzburg, Leydig at Tübingen, and von Mohl, foremost investigator of protoplasm. The surgeon Bardeleben, the clinician Griesinger, and the chemist von Liebig were all customers, as also von Dechen, the Bonn mineralogist. Shipments to foreign countries began and soon increased rapidly.

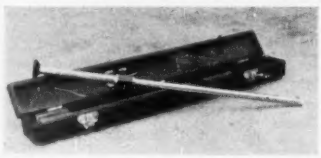
Kellner's first assistant was Morris Hensoldt, a friend of the days when both worked for Repsold in Hamburg. Hensoldt's specialty was machinery, and so he came to Wetzlar in 1849 to take over this side of the business and thus leave Kellner free for research in optics. But this excellent arrangement did not last long, Hensoldt soon going into business for himself. Other helpers were Louis Möller, and Köpper and Cuno Rumann, who later established a shop for physical apparatus in Göttingen, especially noted for their chemical balances. Carl's nephew, Ludwig Engelbert, was his favorite student and confidante, to whom all the trade and manufacturing secrets were given, and it was he who carried on the business during Kellner's illness and for awhile after his death in 1855.

In 1856 Engelbert set up for himself in Oberndorf, joined Hensoldt in Braunfels in 1861, and four years later this partnership came back to Wetzlar and carried on in separate shops. Another relative, Wilhelm Seibert, was trained by Kellner to be a first-class mechanic and optician. In all, twelve assistants were taught and aided by the young Carl, so that his brief career resulted not only in the founding of a great optical company but also in the education of others who later became notable workers in this field.

Assistant Friedrich Belthle became his successor in more ways than one. Kellner had married Maria Werner, adopted daughter of his old math teacher at Giessen. Their only child had died in infancy. Although Kellner had trained his nephew Engelbert to carry on the plant, it was Belthle who married Carl's widow a year after the founder's death and thus became the firm's new owner and manager.

A portrait of Carl, made when he was 23, shows a sensitive youth with a countenance of great beauty, yet the expression is profoundly tragic and the pallor unhealthy. The eyes are far apart and deeply set, the forehead high, the jaw firm. His untimely death from pulmonary tuberculosis when only 29 years of age was a great loss to science, to industry, and to Wetzlar. One cannot help but wonder what he would have accomplished had he lived a normal span, for even in the five short years of Kellner's career as an inventor and manufacturer, he had turned out 131 microscopes and his oculars were to be found in all important observatories. Remember, too, that all such items were individually handmade in his day — none of your assembly-line production in the eighteen fifties. Throughout his superintendency the orders continued to mount. In 1854 he became ill and sought to recover his health at a sulphur springs in a nearby highland resort. It was in vain. Just before his death he was honored by the award of a gold medal for the excellence of his products.

We shall continue this account, the next chapter dealing with the era of Belthle.



Testa Borescope

TESTA PRODUCES BORESCOPE

THE curious gadget shown in an accompanying illustration is neither a flute nor a sliderule, but a microscope. Aptly named the *Borescope*, this heavily chrome-plated tube is only one-half inch in diameter, and is made to insert through holes so as to inspect the interiors of engine cylinders, crack cases, and the like, to study surface wear, porosity, corrosion, detect cracks, and lead to acceptance or rejection of a fabricated part without the necessity of disassembly.

The business end of the borescope houses an elliptical first-surface mirror, the viewing end an erecting eyepiece that can be pushed in or out for coarse focusing and rotated for fine adjustment. Between the two lies a set of twelve highly corrected, achromatized, fluoride-coated lenses, with a visual field of approximately 30 degrees. By adjusting the mirror and rotating the scope, any interior surface may be inspected. Magnifications vary with the distance from mirror to object, the range being from 2 to 6.25X.

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concentric ducts from the electric bulb at the inner end to the special plug near the eyepiece. The bulb is acid-frosted, 12 V., 0.35 Amp., and is used with a transformer with a 40-foot cord extension. A brightly illuminated and magnified view of the interior of a machine part is thus secured. For prices and details, write the Testa Manufacturing Company, 418 South Pecan St., Los Angeles 33, California.

SCIENCE SHOPS

4. Villa Alba Laboratory

IN THE third installment of this series, we dealt with the history of one of the world's largest science shops, the Fisher Scientific Company. Now we shall swing the pendulum all the way over to one of the smallest — certainly you cannot have a personnel smaller than one man —and at the same time a shop that is of special interest to microscopists, for the primary sales items are prepared microscope slides. This is the Villa Alba Laboratory, formerly at Delphi, Indiana, now removed to an isolated farm on a hilltop, near Pekin, Indiana. From this remote and unlikely situation come some of the world's most expertly prepared microscope slides, the product of George Zebrowski, who *is* the Villa Alba Laboratory.

Zebrowski was born in Warsaw, Poland, in 1895. Becoming naturalized in the United States, he graduated B. S. from Purdue in 1921, took the M. S. degree in 1923, then turned to law, with the LL. B. from Blackstone College, Chicago, in 1930, and the J. D. from the Chicago College of Law in 1937. For awhile, 1921-23, Zebrowski was an assistant in biology at Purdue, then for the next six years a professor at Villanova College. The Marines gave him a stint of work from 1917 to 1919, and he has at various times been a chemist (city chemist and bacteriologist, Hammond, Ind.), lawyer, farmer, and technician, especially as chief technician and parasitologist for the Carolina Biological Supply Company, Elon College, N. C. (see article number 2 in this series). He is a member of the American Association, Society of Parasitologists, Entomological Society, Indiana Academy, Pennsylvania Academy, and other scientific organizations. His chief investigations have been on hog lungworms, dog ticks, parasites of birds, new genera of Cladochytriaceae, and shell-boring algae and fungi. He once named a fossil species of fungus after the man who writes this Department, thus insuring him undying fame, and to get even we might add that our acquaintance with George Zebrowski dates back to that time in his gastronomical youth when we have seen him demolish two huge banana splits in rapid succession without the quiver of an eyelash.

There are schools and colleges who probably do not know of Zebrowski's laboratory, but may be using his slides none the less, since he makes them only to order and in quantity lots. Most of the nation's other science shops that carry slides order at least some of their items from Villa Alba and then resell them. He is especially noted for his preparations in histology, embryology, and parasitology; probably no one makes as many chick embryo slides, both whole mounts and sections, per year as Zebrowski. Special orders are his dish — in this case a Petri dish. For example, Dr. John G. Sinclair ordered for the University of Texas Medical School at Galveston 200 sets of chick embryo skip serial sections that would illustrate *exactly* the sections shown in Arey's *Developmental Anatomy!* No large firm could afford to accept such an order.

In addition to preparing slides to order, Zebrowski deals in embedded tissues in paraffin blocks, accompanied by a sample slide to show what may be expected from the block; cultures and laboratory animals, as white rats or *Drosophilae* of many mutations. For years he tried to get the teachers of biology in this country to substitute the vinegar eel, *Anguillula aceti*, for the parasitic roundworm, *Ascaris*, as the type form for the Phylum Nemathelminthes, his arguments being that a small and compact culture is cheaper to buy and store, that a free-living species is more typical than a parasite, and that all stages and phases are present in one culture, easily visible, and with the internal anatomy showing clearly without dissection, under low magnification. He has introduced many new techniques in microscopy, some of which are still unpublished.

As a tip to those teachers whose appropriations are limited, Zebrowski will make slides and supply specimens not alone for cash, but will use the good old method of barter. Do you have a piece or so of obsolete equipment stored away in some unused space? Some while back his laboratory was destroyed by fire, and he will exchange for equipment, even outmoded items, preserved specimens for mounting and sectioning, books, and technical papers. Address: Villa Alba Laboratory, Pekin, Ind.

HISTORICAL OUTLINE

PARASITOLOGY began as a synthetic science. As we have seen, it comprises three main divisions, there being three main kinds of animals that have adopted the parasitic way of life. Both free-living and parasitic species occur in each of the four classes of protozoa, and all constitute the subject matter of the protozoologist, but only those dwelling in the bodies of higher animals would be dealt with in *Medical Protozoology*, the term "medical" covering veterinary as well as human medicine. Likewise there are many sorts of worms, some free, others parasitic; but only the latter are studied in *Helminthology*, the science of parasitic worms. Lastly come the insects, ticks, and mites of the Phylum Arthropoda, considered in *Medical En-*

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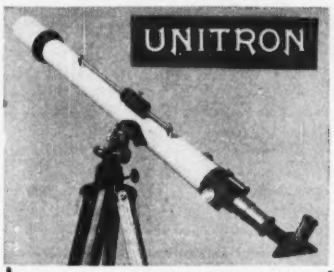

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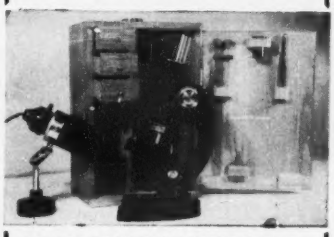

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tomology, which is but one phase of the vast field of entomology in general, other specialties being, for example, insect morphology, and economic entomology.

Parasitology has for its subject matter, then, three chapters plucked from the book of general zoology; — and if this were all, it could scarcely lay claim to the status of an independent science. But the parasitic way of life is something common to all these diverse forms of animals, and puts its stamp upon them. In order to qualify as a successful parasite the animal, whether amœba, worm, or flea must, through a long succession of evolutionary changes, conform to certain requirements. There are some things it can do, others it must do, and still others it may not do. Its life and habits are intimately bound to those of its host; its distribution is limited to that of the host. There result certain host-parasite relationships which transcend anything found in a study of free-living types and provide the parasitologist with instances of special laws and principles: — these, together with discoveries of distinct kinds or methods of culturing, inoculating, experimenting, prevention, immunity, cure, and the like have conferred on parasitology the status of a separate science in its own right.

A history of descriptive or taxonomic parasitology would concern itself with accounts of the chief parasitic species, chronologically listed in the order of their discovery, beginning with the finding of *Fasciola hepatica*, the sheep liver fluke, by Jehan de Brie, in 1379. It would also discuss the linking of parasites with specific disease conditions, as the case of Forde and Dutton, in 1901, discovering that African sleeping sickness is caused by the flagellate protozoan, *Trypanosoma gambiense*. Save for the larger and more obvious worm parasites, this history would be bound up with the history of the microscope. In a way, medical protozoology, helminthology, and medical entomology, could all have separate histories; — but collectively these would not constitute a history of parasitology.

Our previous chapter recounted the discovery of a basic biological principle — alternation of generations — destined to feature as a major phenomenon in helminthology, and shortly we shall have occasion to consider other fundamentals. But first, let us see what was done with von Chamisso's discovery, alternation of generations, also termed metagenesis, first announced by this poet-naturalist in 1819.

Similar observations were made by the Norwegian marine zoologist, Michael Sars (1805-1869) and the Swedish explorer and museum zoologist, Sven Loven (1809-1895), but it remained for a Dane to work out this principle comparatively, and mark it as an important milestone in both zoology and parasitology. This man was Johannes Japetus Smith Steenstrup (1813-1897) of Copenhagen, versatile investigator in marine biology, botany, geology, and archaeology. Reading the forgotten pronouncement of von Chamisso, and influenced by Loven's studies on *Campanularia*, a hydroid, Steenstrup proceeded to investigate metagenesis on a wide scale. His treatise *On the Alternation of Generations* was published in 1842, and described instances of this phenomenon in hydroids, medusae, *Salpa*, and trematodes.

Steenstrup also wrote papers on parasitic crabs, the migration of the flounder's eye across the head during development, and on peat bogs and kitchen middens. During forty years, from 1845 till 1885, when he retired, he held the positions of professor of zoology and director of the zoological museum at Copenhagen, and was noted for his industry and wide interests.

The stage was now set for life history studies on the larger parasites.

BIOLOGICAL LABORATORY MANUALS

X. General Biology

TWO recent laboratory manuals are totally unlike, so much so as to seem designed for entirely different courses. The first is morphological, the second functional.

A good stiff workout for the student is provided in *Basic Exercises in College Biology*, by Dawson and Etkin, of CCNY. Possibly these authors felt that too much was being done for the student, such as providing all drawings ready-made and requiring only that they be labeled, and those teachers who agree will do well to inspect this book carefully. Every assistance is furnished. There are outline how-to-do-it sketches, labeled drawings from aspects other than those required, habit sketches, and even stencils to aid in making symmetrical outlines of frog, pig, and a circle, used as a microscope field. The directions are full and precise, with constant reference to the junior author's text. But aside from all these legitimate aids, the dissection, observation, experiment, and drawing is up to the student.

Alternative sequences of assignments are presented for the science major and the non-science student. From use of the microscope and cells the manual proceeds through the plant and then the animal kingdom. Both the frog and fetal pig are given. At the end are three exercises on development, mitosis and meiosis, and inheritance. Textbook size but spiral binding and flexible covers are used. Pp. viii, 232; figs. 87, 3 in color. Thomas Y. Crowell Co., 432 Fourth Ave., New York 16, 1951. $5.00.

A work book of animal and plant functional studies is the *Experiments in General Biology* by DuShane and Regnery, of Stanford. Drawings are held to a minimum and, when called for, are usually no more than small sketches. Reports submitted consist of experimental results, filled tables and graphs, and answers to questions. In our opinion, this form of laboratory course is today more useful and practical for the non-science student, who will take no further biological work, than a series of laboratory exercises involving mostly dissection and anatomical studies. On the other hand, it is much too one-sided for the biology major, who would require another beginning course in structure and classification; for as much as the experiment-minded teacher might wish, it is impossible to build a firm foundation on other than morphological ground.

The work is well presented and illustrated and the book attractively printed. There is more emphasis than usual on exercises in probability and genetics, while those on adaptation, distribution, and ecology, often omitted, should interest the student considerably. A useful feature is a comprehensive list of equipment and materials, and of methods of preparation, assembled as an Appendix. Pp. vii, 182; figs. 40. W. H. Freeman and Co., 549 Market St., San Francisco 5, 1950. $2.00

POSTMOR TEMQUOTES

MANY a time has Art languished for lack of histologic knowledge on the part of otherwise celebrated individuals. See the improvement that indubitably would have accrued had they been histologists:

Poe:

"Take thy beak from out my cardiac muscle, and
Take thy neuromotor mechanism from off my door!"
Quoth the Raven, "Nevermore."
—The Raven

Francois Villon:

Flies in the milk I know full well:
I know the astrocytes in brains:
I know Purkinje's gorgeous cell:
I know that neurons run in chains:
I know to mark them by their stains:
I know how vessels run through bone
And eke the arteries from veins:
I know all save myself alone.
—Ballad of Things Known and Unknown

Shakespeare:

Will all great Neptune's ocean wash these polymorphonuclear
Leucocytes from my hand? No; this my pentadactylous appendage
Will rather the multitudinous seas incarnadine,
Making the Fast Green FCF appear as Neutral Red.
—Macbeth, II, 1.

Omar Khayyam:

Each Morn a thousand new Mitoses brings, you say;
Yes, but whereso desquamate the Cells of Yesterday?
And this first Summer month that jams the Spleen
Shall take a million Erythrocytes away.
—Rubaiyat, IX.

2nd Lt. Joseph C. Rodriguez

U.S. Army

Medal of Honor

SIXTY YARDS TO GO. From atop the hill, near Munyo-ri, Korea, the enemy suddenly opened up a withering barrage. The squad was caught; Red mortars began zero-ing for the kill. Lieutenant Rodriguez (then Pfc., with only seven months service) broke loose and dashed up the fire-swept slope, throwing grenades. Disregarding the fire concentrated on him, he wiped out three foxholes and two gun emplacements. Alone, he accounted for 15 enemy dead, led the rout of the enemy, and saved the lives of his squad.

"When you have to take chances to reach an objective, that's O.K.," says Lieutenant Rodriguez. "But when you can find a safer way to your goal, so much the better.

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